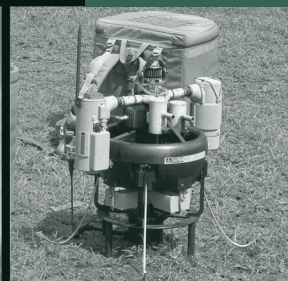
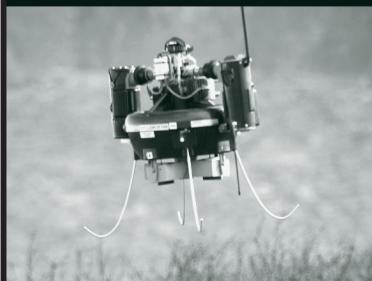


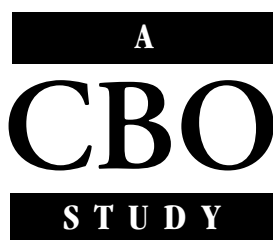
A
CBO
STUDY

JUNE 2009

An Analysis of the
Army's
Transformation
Programs and
Possible Alternatives



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An Analysis of the Army's Transformation Programs and Possible Alternatives

June 2009

Notes

Unless otherwise indicated, all years referred to in this study are fiscal years, and all costs are expressed in 2009 dollars.

Numbers in the text and tables may not add up to totals because of rounding.

All of the photographs on the cover of this study were provided courtesy of the Army's Future Combat Systems program (www.fcs.army.mil).



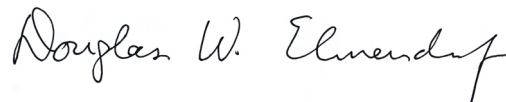
Preface

The Army has initiated two programs designed to transform itself from a force focused on fighting the Cold War to one better designed to face the challenges of the 21st century. Those two programs, the Modularity Initiative and the Future Combat Systems (FCS) program, would change the way the Army is organized and equipped, respectively.

This Congressional Budget Office (CBO) study, which was prepared at the request of the Chairman of the Readiness Subcommittee of the House Committee on Armed Services, considers the near- and long-term implications of those two programs. It also examines three alternatives for modernizing the Army's combat forces using modified versions of the FCS program and estimates the costs and savings of those options as well as their effects on the Army's ability to introduce new technologies into its combat brigades. In keeping with CBO's mandate to provide objective, impartial analysis, this report makes no recommendations.

Frances M. Lussier of CBO's National Security Division prepared the study under the general supervision of J. Michael Gilmore. The author would like to thank Bernard Kempinski of CBO for his assistance in fact checking the document as well as James Quinliven of the RAND Corporation for his comments. (The assistance of an external reviewer implies no responsibility for the final product, which rests solely with CBO.) Paul Cullinan, Sarah Jennings, and Jason Wheelock, all of CBO, provided comments on earlier drafts of the report.

Christine Bogusz edited the paper, and John Skeen proofread it. Cynthia Cleveland produced drafts of the text and tables. Maureen Costantino prepared the paper for publication and designed the cover. Lenny Skutnik printed the initial copies, Linda Schimmel handled the print distribution, and Simone Thomas prepared the electronic version for CBO's Web site (www.cbo.gov).



Douglas W. Elmendorf
Director

June 2009



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Summary

In the past decade, the Army initiated two programs designed to dramatically alter the way its combat forces are equipped and organized. The Modularity Initiative would reorganize the Army's warfighting forces from divisions containing 12,000 to 17,000 or more soldiers to a larger number of smaller, interchangeable, and independent brigade combat teams (BCTs) of 3,000 to 4,000 soldiers. Before changes in the program were made on the basis of Secretary of Defense Robert M. Gates's announcement in April 2009, the Future Combat Systems (FCS) program would have, among other things, replaced the Army's heavy tracked armored vehicles developed in the 1960s and 1970s with lighter and more mobile combat vehicles that would be equally as survivable. (See Summary Box 1.) Army leaders have contended that together those two programs would yield an Army that could respond to crises around the world more quickly and that would be more mobile and technically sophisticated—and, hence, more effective—once it arrived.

In this analysis, the Congressional Budget Office (CBO) examines the Army's Modularity Initiative and FCS program as included in the previous Administration's 2009 plan to see if they could have met their initial goals. CBO addresses the question of whether the Army's current combat units are better able than their predecessors to respond to crises overseas. CBO also evaluates the effect that the FCS program included in the previous Administration's 2009 plan would have had on the Army's armored vehicle fleet and the combat units that it was expected to equip. In addition, CBO attempts to identify the costs through 2030 of the Army's Modularity Initiative and the FCS and related modernization programs in the previous Administration's 2009 plan. Last, the agency examines the advantages and disadvantages of several alternative plans for modernizing the Army's combat brigades, primarily focusing on units equipped with armored vehicles.

As planned, the Army's Modularity Initiative has resulted in the creation of additional combat brigades. However, CBO's analysis of that initiative shows that the program has cost more and yielded fewer benefits than were originally estimated.

- The Army has had to add personnel to support the additional units;
- The planned increases in personnel are unlikely to be sufficient to fully support the force structure of 76 BCTs that was planned at the end of 2008;
- Although modular BCTs might require less time to prepare to respond to an overseas crisis than their pre-modular predecessors, they require roughly the same amount of time to transport their equipment overseas; and
- The costs to carry out the initiative have grown beyond the initial estimate of \$21 billion and may total more than \$140 billion through 2013.¹

CBO's analysis also reaches the following conclusions concerning the Army's FCS program included in the previous Administration's 2009 plan and associated modernization programs:

- The FCS program would have fielded a full set of equipment to less than 20 percent of the Army's BCTs and would not have been completed until 2030;
- Although one of the main goals of the FCS program was to speed the movement of Army combat units overseas, replacing the current armored vehicles with FCS manned vehicles would not have significantly reduced transportation times;

1. Unless otherwise noted, all costs are expressed in 2009 dollars.

Summary Box 1.

Implications of the New Administration's Fiscal Year 2010 Plan for the Army's Transformation Programs

This Congressional Budget Office (CBO) analysis is based largely on modernization plans for the Army's transformation programs as outlined in documents that the Bush Administration submitted to the Congress in conjunction with its fiscal year 2009 budget request. In early April 2009, Secretary of Defense Robert M. Gates outlined changes to plans for both the Army's Modularity Initiative and its Future Combat Systems (FCS) program that he recommended be incorporated into the Obama Administration's fiscal year 2010 defense budget request. Those changes included:

- Reducing the active Army's goal for combat units by 2013 from 48 brigade combat teams (BCTs) to 45 brigade combat teams and
- Canceling the manned vehicle portion of the FCS program and accelerating the "spin-out" of FCS technologies to all of the Army's brigade combat teams, rather than just infantry brigades.

Although the 2010 request was submitted shortly before CBO published this report, that request did not contain sufficient programmatic details to allow CBO to conduct a complete reassessment of either the revised Modularity Initiative or the FCS program. Moreover, the Administration announced that, unlike previous budget requests, the fiscal year 2010

request would not be accompanied by revised and updated Selected Acquisition Reports (SARs), which would have supplied programmatic details for the FCS program for years after 2010. For those reasons, CBO relied on details contained in or accompanying the previous Administration's 2009 plan to conduct its analysis of the Modularity Initiative. In particular, CBO relied on the most recent SAR, submitted in December 2007, to analyze the cost, schedule, and effects of the FCS program on the Army's forces.

Although details concerning the revised FCS program will most likely not be available until the fall of 2009, the general outlines for that program were included in Secretary Gates's announcement. The changes he announced, including the cancellation of the manned vehicle portion of the FCS program and an acceleration of the introduction of spin-out technologies into the Army's BCTs, closely parallel the changes in the previous FCS program that are included in Alternative 1 in this report. Thus, although the program described in Alternative 1 and the FCS program included in the Obama Administration's 2010 budget are most likely not identical, CBO's analysis of the effects of Alternative 1 on the Army's forces should yield some insight into the likely impact of a restructured FCS program that fits the description of the program outlined by Secretary Gates.

- According to the Army's estimates, the annual costs of the FCS program and its associated Spin-Out program could have approached \$10 billion at their peak, an expenditure that could have been difficult to afford given other demands on the Army's budget;
- Alternative approaches to introducing FCS technologies into the Army's combat units—approaches that would eliminate all or part of the program's ground vehicles while retaining its communications network and, in some cases, its components with sensors to detect enemy troops and their movement—would yield annual savings of \$3 billion to \$8 billion in the cost of FCS-related programs included in the previous Administration's 2009 plan; and
- Because FCS manned vehicles would not have replaced the armored combat vehicles in all of the Army's BCTs, additional annual funding of \$2 billion to \$4 billion could have been required over the next 20 years to modernize vehicles that the Army will retain indefinitely.

The Army's Modularity Initiative

In February 2004, the Army announced that it would restructure its combat forces to make them more agile and flexible. Most of the service's combat forces at that time were organized into divisions that could include more than 17,000 personnel, a structure that had not been well-suited to some of the Army's previous operations (such as the one in Bosnia) that called for less than a full division's worth of combat forces. To create a more responsive force, then Army Chief of Staff General Peter Schoomaker introduced the Modularity Initiative, which would reorganize the Army from one based on divisions, several of unique design, to one based on brigade combat teams of 3,000 to 4,000 soldiers, each being one of only three designs. General Schoomaker stated in 2004 that the conversion would be accomplished in three years, without the need for additional military personnel, and at a cost of \$21 billion. Since then, however, the Modularity Initiative has grown in scope, duration, and cost.

Description of the Modularity Initiative Included in the Previous Administration's 2009 Plan

As described in early 2008, the Modularity Initiative would yield an Army that includes somewhat more combat forces and military personnel in 2013 than it did in 2003 and that is organized differently. The size of the combat force would grow from a total of 71 ad hoc brigade combat teams in the premodular Army in 2003 to 76 in the modular Army in 2013. The number of military personnel would also increase, climbing from 1,035,000 in 2003 to 1,111,000 in 2013. The Army in 2003 included sufficient combat units to make up 71 brigade combat teams, but those teams had to be assembled from individual and separate combat and support units from within the Army's divisions. In contrast, the new modular BCTs are designed to be stand-alone units, each with some of its own support troops.

Although the overall size of the Army's combat forces—as measured in terms of soldiers or brigade combat teams—would not change substantially as a consequence of the Modularity Initiative, their composition would. In 2003, the majority of the Army's combat forces were in the National Guard and were designed to be mobilized in a few months if needed in the event of a large ground war, such as that envisioned with the Warsaw Pact during the

Cold War (see Summary Figure 1). Reflecting a change in national strategy, the structure planned by the previous Administration for 2013 entailed an increase in combat forces in the active Army (from 33 BCTs to 48 BCTs) and a decrease in combat forces in the National Guard (from 38 BCTs to 28 BCTs).² (The Army Reserve includes no BCTs.) Other planned changes in combat forces are a decrease in the number of brigade combat teams that contain tanks or other armored combat vehicles, from 50 in 2003 to 33 in 2013—with the largest reduction planned for the National Guard—and a larger increase in the number of BCTs that include no armored vehicles, from 21 to 43.³ (For a brief description of the three components of the Army and their respective roles, see Summary Box 2.)

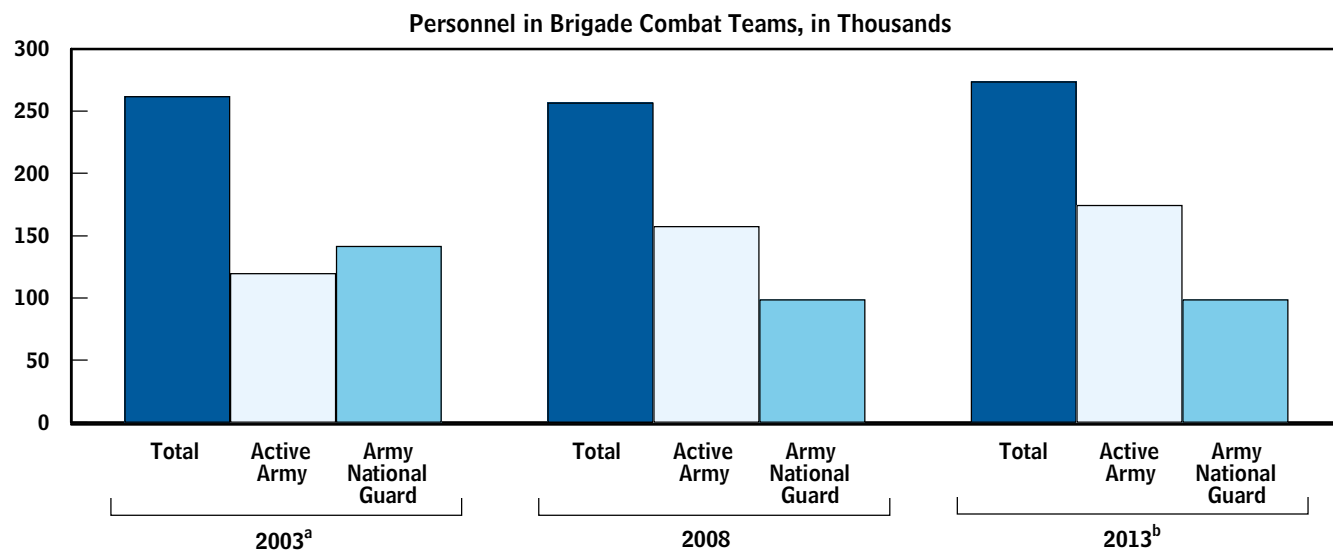
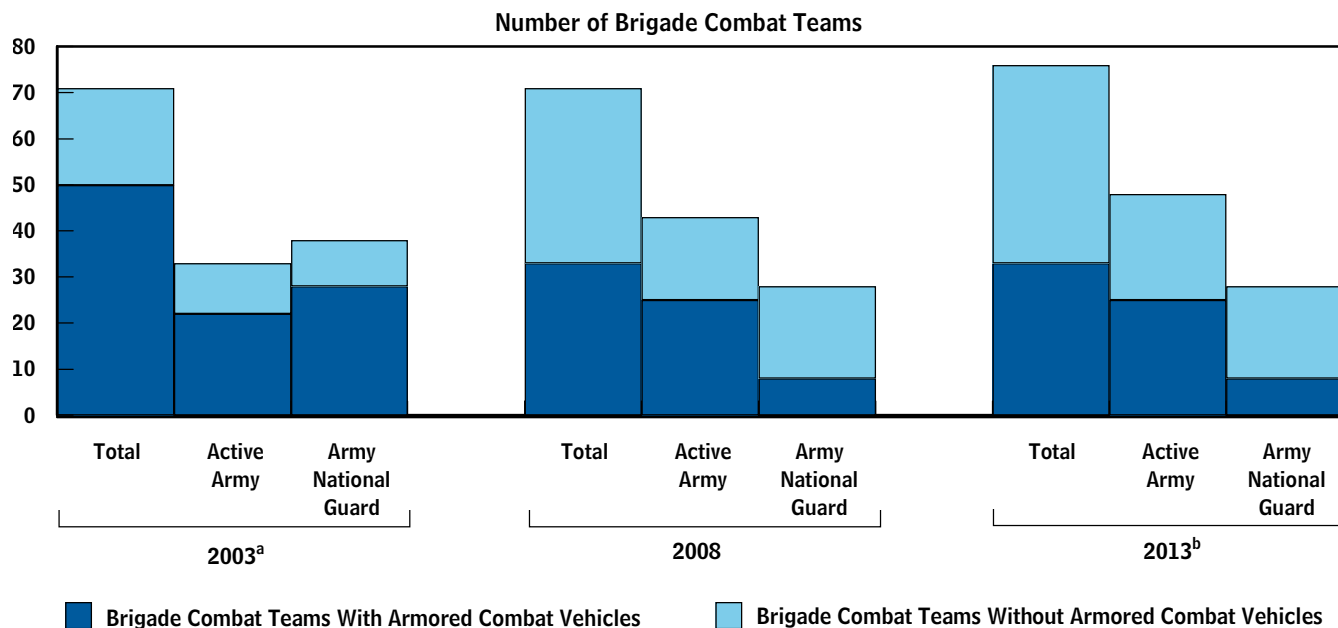
Costs of the Modularity Initiative

The overall costs through 2030 of the Army's Modularity Initiative included in the previous Administration's 2009 plan, including costs to reorganize units and add brigade combat teams and personnel, could exceed \$250 billion, in CBO's estimation. Costs for the additional personnel included in the initiative would account for the greatest portion of that total—\$118 billion from 2009 through 2030. Costs for operation and maintenance could also be significant—\$79 billion from 2009 through 2030—because the Army might need to hire 16,000 additional civilians to perform administrative tasks previously performed by soldiers. (The Army has stated that it will probably incur additional costs to purchase equipment after 2013 but has not provided specific details of what might need to be purchased. Consequently, CBO did not include any costs for procurement after 2013.) And the reorganization of the Army's units alone will incur costs because modular units will be equipped differently from the units they replace and may be stationed in new locations (see Summary Table 1). In sum, CBO estimates that the costs for the Modularity Initiative could be nearly \$100 billion from 2009 through 2013 and \$155 billion from 2014 through 2030, yielding a total cost from 2009 through 2030 of \$254 billion.

-
2. Changes announced by Secretary Gates in April 2009 would limit the size of the active Army to 45 BCTs.
 3. Changes announced by Secretary Gates in April 2009 could limit the number of BCTs with no armored combat vehicles to 40.

Summary Figure 1.

Changes in the Army's Brigade Combat Teams Under the Previous Administration's 2009 Plan, 2003 to 2013



Source: Congressional Budget Office based on data from the Department of the Army.

Note: The Army Reserve includes no brigade combat teams.

- a. A brigade combat team in 2003 was composed of one maneuver brigade and additional support units.
- b. Does not reflect Secretary of Defense Robert M. Gates's announcement in April 2009 that the active Army would grow to a total of 45 brigade combat teams rather than the 48 included in the previous Administration's 2009 plan.

Summary Box 2.

The Active Army, the Army National Guard, and the Army Reserve

The Army is made up of three components, which differ in availability and readiness: the active Army, the Army National Guard, and the Army Reserve. Units in the active Army, the majority of which are combat units, are filled with soldiers on active duty, who are always available to respond to orders from the Commander in Chief. At the end of 2008, the authorized end strength of the active-duty force was 525,000 soldiers. (End strength is the number of personnel authorized to be in the Army at the end of the fiscal year.) By contrast, most members of the Army National Guard and Army Reserve are civilians who practice or drill only part time during peacetime but can be called to active duty in the event of a crisis. The National Guard, with 351,000 members at the end of 2008, reports during peacetime to state governors and forms the state militias mandated in the

Constitution. The National Guard includes a mix of combat and support units and provides a force that governors can call on to meet domestic emergencies and maintain civil order. During a national crisis, the President can call members of the National Guard to federal active duty. Because members have to be activated and units mobilized in response to a call from the President, some units may take months to get ready to deploy to an overseas crisis. The 205,000 members of the Army Reserve are assigned almost exclusively to support units and must also first be called to active duty by the President before they can be assigned to military tasks outside the scope of regular training duty. Since September 11, 2001, members of the Army National Guard and Army Reserve have been used extensively to support long-term operations in the United States and overseas.

The Army's Modernization Programs Related to Modularity

The Army has several modernization programs that are a major part of its transformation efforts. The most costly and technically ambitious of those is the FCS program and its related Spin-Out program. The Army also has several programs designed to maintain and upgrade the armored combat vehicles that equip its modular units.

Description of the FCS Program Included in the Previous Administration's 2009 Plan

The FCS program was first conceived by then Army Chief of Staff General Eric Shinseki to develop a new generation of combat vehicles that would be as lethal and survivable as the heavy weapons the Army now fields but that would weigh much less, be easier to transport, and require far less logistical support.

The FCS program would have developed and purchased new vehicles to replace most of the combat vehicles that equip the service's heavy units and several types of unmanned aerial and ground vehicles (to provide remote surveillance and protection). Specifically, under the previous Administration's 2009 plan, the Army would have

developed eight new types of manned armored vehicles, two classes of unmanned aerial vehicles (UAVs), two types of unmanned ground vehicles, unattended ground sensors, and a missile launcher and associated munitions (see Summary Table 2). The final component of the FCS program is the network, which comprises the common operating software and the communications and computer systems that would allow all of the FCS elements to communicate with one another and with the Army's other systems.

Schedule for Fielding Full Brigade Sets of FCS Components. The Army planned to field all 14 FCS components and the associated network in full brigade sets—replacing all of the combat vehicles in a brigade at once—for a total of 15 BCTs. Because of the technological sophistication and complexity of some of the systems, the Army did not expect to field the first BCT to be equipped with all 14 components until 2016. After that, the service planned to equip one additional BCT a year with the full suite of FCS components. Under the schedule in effect at the end of 2008, equipment for the last brigade would have been purchased in 2028 and fielded in 2030.

Summary Table 1.

Costs of the Army's Transformation Programs Under the Previous Administration's 2009 Plan, 2009 to 2030

(Billions of 2009 dollars)

Program and Account	2009-2013	2014-2030	Total, 2009-2030
Modularity			
Military Personnel	25	93	118
Operation and Maintenance	17	62	79
Procurement	44	^a	44
Construction	13	^a	13
Total, Modularity	99	155	254
Modernization			
Future Combat Systems			
RDT&E	12	2	14
Procurement	8	94	103
Subtotal	20	96	117
FCS Spin-Out Program			
RDT&E	*	*	*
Procurement	3	15	18
Subtotal	3	15	18
Combat Vehicle Modernization ^b			
RDT&E	1	1	2
Procurement	6	47	53
Subtotal	7	48	55
Total, Modernization	30	159	189
Memorandum:			
Average Annual Cost			
Modularity	20	9	12
Modernization	6	9	9

Source: Congressional Budget Office based on Government Accountability Office, *Force Structure: Better Management Controls Are Needed to Oversee the Army's Modular Force and Expansion Initiatives and Improve Accountability for Results*, GAO-08-145 (December 2007), p. 18; Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and Marine Corps's Personnel Levels," letter to the Honorable Carl Levin (April 16, 2007); and data from the Department of the Army.

Note: RDT&E = research, development, test, and evaluation; FCS = Future Combat Systems; * = less than \$500 million.

a. Unknown and assumed to be zero.

b. Includes upgrades to Abrams tanks, Bradley fighting vehicles, and M109 howitzers and purchases of Stryker vehicles to replace M113-based vehicles.

Summary Table 2.**FCS Systems and Current Counterparts in the Army's Combat Brigades**

Future Combat System ^a	Mission	Current System Being Replaced
Manned Vehicles		
Mounted Combat System	Destroy enemy	Abrams tank
Infantry Carrier Vehicle	Transport and protect soldiers	Bradley fighting vehicle and M113 armored personnel carrier
Reconnaissance and Surveillance Vehicle	Scout	Bradley fighting vehicle
Non-Line-of-Sight Cannon	Provide fire support	M109 howitzer
FCS Recovery and Maintenance Vehicle	Recover stranded vehicles	M88 recovery vehicle
Command and Control Vehicle	Transport and protect commanders	M113-based vehicle
Non-Line-of-Sight Mortar	Provide fire support	M113-based vehicle
Medical Vehicle	Treat and evacuate wounded personnel	None
Unmanned Ground Vehicles		
Armed Robotic Vehicle-Assault-Light	Perform sentry duty, provide cover	None
Multifunctional Utility/Logistics and Equipment	Carry cargo, detect and counter mines	None
Small Unmanned Ground Vehicle	Investigate small confined spaces	None
Unmanned Aerial Vehicles		
Class I UAV	Provide surveillance out to a distance of 8 km	None
Class IV UAV	Provide surveillance and communications relay out to a distance of 75 km	None
Other Systems		
Non-Line-of-Sight Launch System	Attack with precision out to a distance of 70 km	None
Unattended Ground Sensors	Detect and identify intruders	REMBASS

Source: Congressional Budget Office based on data from the Department of the Army, FCS Program Manager, Brigade Combat Team, *Future Combat Systems Brigade Combat Team: 14 + 1 + 1 Systems Overview* (March 2007); and Army Training and Doctrine Command (TRADOC), Unit of Action Maneuver Battle Lab and TRADOC System Manager FCS, *Family of Systems Battle Book* (January 31, 2005).

Note: FCS = Future Combat Systems; UAV = unmanned aerial vehicle; km = kilometer; REMBASS = remotely monitored battlefield sensor system.

a. Systems included in the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.

The FCS Spin-Out Program

The Army has created the FCS Spin-Out program to introduce some FCS components as soon as they have been developed into Army combat units that are not scheduled to receive the full complement of equipment. The Army's program included in the 2009 plan will equip those modular BCTs that have no armored combat vehicles, known as infantry BCTs, with six of the FCS components—everything except the manned vehicles and

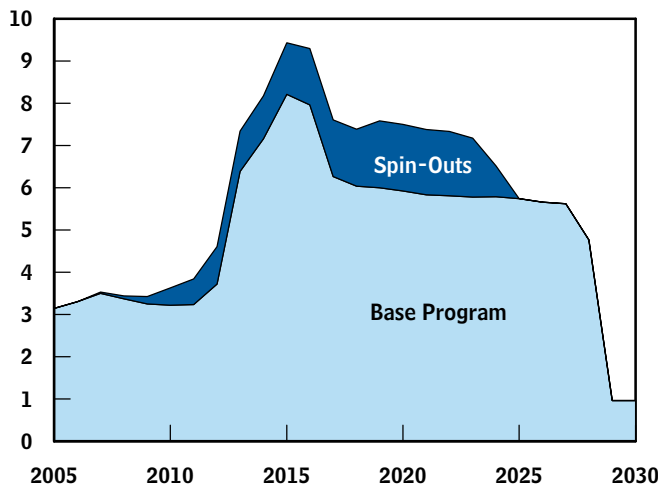
one variant of the larger unmanned ground vehicle.⁴ In addition, some of the high mobility multipurpose wheeled vehicles (HMMWVs) in each infantry BCT will receive equipment enabling them to be connected to the

4. Secretary Gates announced in April 2009 that the Obama Administration's 2010 plan will accelerate the fielding of Spin-Out technology to all of the Army's BCTs.

Summary Figure 2.

Annual Costs of Programs Related to the Future Combat Systems Under the Previous Administration's 2009 Plan

(Billions of 2009 dollars)



Source: Congressional Budget Office based on Office of the Secretary of Defense, *Future Combat Systems: Selected Acquisition Report* (December 31, 2007); and budget data from the Department of the Army.

FCS network so that the information collected by the sensors can be shared throughout the brigade.

Fielding of the various FCS components to the Army's infantry BCTs is scheduled to begin in 2011 with four FCS components, and fielding of the remaining two components included in the Spin-Out program will begin in 2014.⁵ All of the Army's infantry BCTs would have received some FCS components by 2025 under the 2009 plan, although in lower quantities than would have been fielded to Future Combat Systems brigade combat teams.

Programs to Upgrade, Maintain, and Replace the Army's Current Armored Combat Vehicles

The final modernization effort that CBO examined involves the Army's programs to modernize and upgrade the existing armored combat vehicles in its heavy brigade combat teams. CBO examined those programs because

the Army would have retained large numbers of some of its current armored vehicles in its inventories even after FCS fielding was completed in 2030. In particular, the Army planned to retain indefinitely 11 heavy BCTs equipped with existing tanks and other tracked combat vehicles.

Costs of the Army's Modernization Programs

The total cost of the Army's modernization programs included in the previous Administration's 2009 plan could have reached \$189 billion from 2009 to 2030, according to CBO's estimates. The FCS program, which represented by far the biggest single investment that the Army was planning to make during the next 20 years, would have commanded the largest portion of that total, requiring \$14 billion for research and development (R&D) and slightly more than \$100 billion for purchasing 15 brigades' worth of systems.⁶ The Army planned to buy one brigade's worth of FCS equipment each year starting in 2015, and the program would have required annual funding of \$5 billion to \$8 billion from 2013 through 2028 (see Summary Figure 2).

According to the Army, an additional \$18 billion will be needed to carry out the FCS Spin-Out program to equip all of the infantry BCTs with the FCS network and some FCS components (see Summary Table 1 on page xiv). At the end of 2008, the Army planned to buy enough components each year to equip up to four infantry BCTs, and the resultant annual costs from 2014 to 2023 would have averaged \$1.4 billion.

To upgrade its armored combat vehicles, the Army has several programs to develop and procure improved electronics, engines, armor, and other components for installation in existing vehicles. CBO estimates that the Army could invest a total of \$7 billion in such programs from 2009 through 2013, considerably less than the \$11 billion it invested from 2005 through 2008. Although the Army has expressed a desire to upgrade many of the vehicles that will remain in its heavy BCTs until 2040, some of those programs were not well defined after 2013 in its 2009 plan. CBO estimates that total costs between 2014 and 2030 to modernize the Army's armored combat vehicle fleet could reach \$48 billion.

5. Initial fielding will include unattended ground sensors, one of the unmanned ground vehicles, one of the UAVs, the non-line-of-sight launch system, and a rudimentary version of the FCS network.

6. That estimate is based on data in the December 2007 Selected Acquisition Report. CBO was unable to develop an independent estimate of the cost of one brigade's worth of equipment because some of the individual FCS components are not yet fully defined.

Questions Regarding the Army's Transformation Programs

Although the Army has made progress over the past five years in implementing its Modularity Initiative and FCS program, questions remain about the ability of those two programs to deliver the intended results. Additional questions surround whether the Army will be able to complete the programs without investing more time, personnel, or funds than its 2009 plans included.

Will the Army's Increase in Personnel Be Sufficient to Support Its Growth?

Despite the fact that the Army plans to add more than 76,000 personnel by 2013 (compared with its authorized strength at the end of 2003), those additional personnel are unlikely to be sufficient to support all of the combat and support units—or operating force—that the Army was planning to create under its Modularity Initiative. Even though 67,000 personnel would be added to the active Army, that increase is 28,000 soldiers short of the 95,000 additional personnel that the active Army would have needed by 2013 to support 48 BCTs and associated support units. The Army planned to find the additional 28,000 active-duty soldiers that it needed by reducing the number of soldiers that are allocated to other portions of the active Army. (Similar changes are planned for the Army National Guard and the Army Reserve.)

Under the previous Administration's plan, the two major areas of the active Army that were scheduled for personnel cuts are the institutional Army, or generating force—which trains, equips, and manages the operating force—and the Individuals Account, which includes soldiers who are part of the active Army but are not assigned to units. (The latter group includes soldiers in basic training and between assignments, for example.) The Army planned to reduce the number of active-duty soldiers in those two personnel pools by assigning some tasks currently performed by soldiers—such as designing and purchasing weapons—to civilians or contractors and by reducing the number of soldiers in the Individuals Account through improved management practices.

The Army planned to find the 28,000 additional active-duty soldiers it needed to fill its combat and support units through a reduction in its generating force. However, reducing the generating force in the active Army by moving tasks from the military sector to the civilian sec-

tor may be difficult or inadvisable. Military personnel are better suited for recruiting new soldiers, being drill sergeants, and establishing new unit structure and tactics—jobs all performed by the generating force—than are civilians. To make the proposed task even more difficult, the active Army reduced by 15,000 the number of military personnel assigned to its generating force between 2003 and 2007 and thus may already have transferred to the civilian sector those jobs that are easiest to convert.

The Army also planned to reverse the increase in the size of its Individuals Account in the active Army that took place between 2003 and 2007. Such a reduction was needed to provide the active-duty soldiers required to fill the operating force included in the previous Administration's 2009 plan. That task may be even more difficult than reducing the size of the generating force. In the active Army, new recruits who are in training and have not yet been assigned to units account for more than half of all soldiers in the Individuals Account. Because the active Army will grow in size between 2007 and 2013, it will need to recruit and add more soldiers each year, yielding a growing number of trainees, rather than a smaller number. Other major contributors to the account—cadets at West Point, as well as officers and soldiers in school—are also not likely to shrink as the Army itself grows. Previous analyses by the Army's personnel managers have found that the size of the Individuals Account grows, relative to the overall size of the Army, during periods when the Army itself is expanding. Given the constraints that are likely to limit the Army's ability to transfer the needed personnel from its generating force and Individuals Account to its operating force, CBO concluded that the Army might need to either request further increases in its end strength or, as Secretary Gates announced that the Obama Administration intends to do, cut back its plans for expanding its force structure.

Are Modular Units Easier to Deploy than Similar Premodular Units?

Another purpose of the Modularity Initiative and the FCS program was to create combat units that would be easier to send overseas than premodular units. One way to make units easier to deploy is to reduce the weight of their associated equipment. But modular BCTs, in general, include roughly the same number of personnel and vehicles as their corresponding premodular teams. As a result, modular units equipped with current weapon

Summary Table 3.

Comparison of the Army's Premodular and Modular Brigade Combat Teams

Type of Brigade Combat Team	Personnel	Equipment			Delivery Requirements ^b	
		Armored Vehicles ^a	Trucks ^a	Total Weight (Tons)	Cargo Aircraft Sorties ^c	Days ^d
Premodular ^e						
Infantry						
Light	2,700	0	420	2,900	70	4
Airborne	3,100	0	570	4,200	100	6
Heavy	3,800	450	840	25,000	480	26
Modular						
Infantry	3,400	*	1,000	7,400	170	10
Heavy	3,800	350	950	22,800	440	24
Stryker	3,900	320	700	14,900	350	19
FCS ^f	3,300	320	700 ^g	21,800	420	23

Source: Congressional Budget Office based on Military Traffic Management Command Transportation Engineering Agency, *Deployment Planning Guide: Transportation Assets Required for Deployment*, MTMCTEA Pamphlet 700-5 (May 2001); Department of the Air Force, *Air Mobility Planning Factors*, Pamphlet 10-1403 (December 18, 2003); and data from the Department of the Army.

Note: * = fewer than 5 vehicles; FCS = Future Combat Systems.

- a. Rounded to the nearest 10 vehicles.
- b. Needed to deliver unit equipment to an overseas location in Eastern Africa.
- c. Rounded to the nearest 10 sorties and based on an average payload per sortie of 52 tons for heavy and FCS units and 43 tons for all other units.
- d. The number of daily sorties is constrained by the capacity of airfields in Eastern Africa.
- e. Premodular brigade combat teams are composed of several divisional units, including one maneuver brigade and several supporting units. Not all types of premodular brigade combat teams are included in the table.
- f. Based on the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- g. Includes 110 unmanned ground vehicles weighing roughly 3.5 tons each.

systems are not significantly lighter than their predecessors and, in some cases, weigh more (see Summary Table 3). Because the modular units weigh almost as much as or more than their predecessors, they do not require significantly fewer cargo aircraft sorties or shiploads to transport them overseas. Consequently, it would take roughly the same amount of time to deliver modular units to a particular destination as it would take to deliver premodular formations of the same type.

Equipping units with FCS vehicles would not have made units easier to transport overseas. An FCS-equipped BCT, as conceived at the end of 2008, would have yielded less than a 5 percent reduction in the time needed to deploy by air, as compared with a heavy BCT (see Summary Table 3). Furthermore, because FCS BCTs existed only

on paper and were based on many assumptions about the weight and fuel efficiency of FCS vehicles—which also did not yet exist—the weight of an FCS-equipped BCT could have continued to grow as it had over the past few years.

Are the FCS-Related Programs Affordable?

Based on Army plans and estimates at the end of 2008, the FCS and Spin-Out programs would have required funding approaching \$10 billion annually starting in 2015, the first year in which the Army was scheduled to buy one BCT's worth of the full complement of FCS equipment. During the preceding five years, the program would have consumed increasingly larger shares of the Army's planned procurement budget. If the Army's procurement funding grew after 2013 at a rate equal to infla-

tion—that is, if it remained at the same level in constant 2009 dollars—the share of the Army's planned procurement budget consumed by the FCS and Spin-Out programs would have risen from almost 5 percent in 2011 to roughly 40 percent in 2015 and 2016 and remained above 30 percent through 2023.⁷ (In comparison, the Army's purchase of ground combat vehicles during the 1980s accounted for 20 percent to 24 percent of the service's total procurement budget.) Dedicating such a large portion of the Army's procurement funding to the FCS-related programs might not have left sufficient money for purchasing other weapon systems (such as helicopters) or needed support equipment (such as trucks, generators, and ammunition).

Would the Limited Fielding of FCS Technologies in Army BCTs Have Been Worth the Investment?

The FCS program was originally intended to inject new technologies into all of the Army's brigade combat teams early in the 21st century. As the fielding of fully equipped FCS BCTs slipped farther into the future and was limited to fewer brigades, however, the Army created the Spin-Out program to field to more of its combat units smaller quantities of some technologies as soon as they became available. The combined effect of those two programs, as included in the previous Administration's 2009 plan, was to put at least some FCS technology into almost 70 percent of the Army's BCTs by 2025. However, at that time, only 13 percent of the Army's BCTs would have had the full set of FCS equipment—all 14 components and hardware to connect the majority of a brigade combat team's vehicles, including all of its combat vehicles, to the network. Twenty three BCTs, representing roughly 30 percent of the total, would have had no FCS-related hardware.

Alternative Approaches to Modernizing the Army's Combat Forces

CBO analyzed three alternatives for modernizing the Army's combat units that would address concerns about the FCS program—specifically, its affordability as it was structured in 2008 and the slow rate of introduction of its systems into the Army's combat units. Under the first two

alternatives, the Army would retain different components of the FCS program (to emphasize systems that would contribute to different objectives of modernization) while canceling the remainder (see Summary Table 4).

- Under Alternative 1, which closely resembles the FCS-related programs likely to be included in the Obama Administration's 2010 plan, the Army would develop and purchase the full suite of sensors called for in the FCS program (to provide enhanced information-collection capabilities), the non-line-of-sight launch system (to attack targets), and a version of the FCS network (to disseminate that information). None of the other large ground vehicles would be developed. With greater knowledge about the location and character of potential threats and the whereabouts of allies, the Army's forces would be better able to respond and act appropriately, either individually or in concert.
- Under Alternative 2, the Army's primary focus would be on introducing new vehicular technology into its heavy BCTs by developing several of the new manned ground vehicles in the FCS program (particularly those that would replace the older armored combat vehicles currently in the fleet). A secondary focus would be on developing and purchasing a modified version of the FCS network to enhance communication within the brigade.
- Under Alternative 3, the Army would develop a scaled-down version of the FCS network (as under the other two alternatives). All other elements of the FCS program would essentially be canceled.

Under all of the alternatives, the service would modernize its existing armored vehicle fleet by integrating into those vehicles the capabilities associated with the retained portions of the FCS network, when they become available.

Alternative 1. Accelerate the Fielding of FCS Technologies Through the Spin-Out Program

CBO estimates that the Army would spend a total of \$96 billion from 2009 through 2030 under this alternative, a substantially smaller amount than the \$189 billion projected for the Bush Administration's 2009 modernization programs over the same period. The costs of developing and purchasing the FCS components under this alternative would be \$31 billion, in CBO's estimation, and the costs of upgrading and modernizing the existing

7. To put that assumption in historic context, the Army's procurement budget has experienced several peaks and valleys since 1960. Procurement funding in two-thirds of those years was less than that planned for 2013. The average procurement funding between 1960 and 2013 is \$19 billion, \$5 billion less than that planned for 2013 under the previous Administration's 2009 plan.

Summary Table 4.
Emphasis of and Components Included in Modernization Alternatives for the Army

Alternative	Emphasis	FCS Components ^a	
		Retained	Canceled
Alternative 1	Information collection and sharing	Scaled-down network UAVs, Classes I and IV Unattended ground sensors Small unmanned ground vehicle Non-line-of-sight launch system	Manned vehicles (All) Large unmanned ground vehicles (All)
Alternative 2	New vehicular technology	Scaled-down network Manned vehicles Medical Infantry carrier ^b Non-line-of-sight mortar Non-line-of-sight cannon Command and control	Unmanned ground vehicles (All) Manned vehicles Mounted combat system FCS recovery and maintenance Reconnaissance and surveillance UAVs, Classes I and IV Non-line-of-sight launch system Unattended ground sensors
Alternative 3 ^c	Current systems	Scaled-down network	Manned vehicles (All) Unmanned ground vehicles (All) UAVs, Classes I and IV Unattended ground sensors Non-line-of-sight launch system

Source: Congressional Budget Office.

Note: FCS = Future Combat Systems; UAV = unmanned aerial vehicle.

a. Based on systems included in the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.

b. Under Alternative 2, the Army would buy roughly 25 percent of the infantry carrier vehicles included in the previous Administration's 2009 plan.

c. Alternative 3 includes two variants that connect different quantities of vehicles in a brigade combat team to the network.

armored combat vehicle fleet would be \$65 billion (see Summary Table 5). Annual costs to implement this alternative, which would range from \$4 billion to slightly more than \$8 billion from 2012 to 2020, would be less than the corresponding annual costs under the Bush Administration's 2009 plan (\$6 billion to \$12 billion) over the same period (see Summary Figure 3).

This alternative would introduce FCS-based technologies into the Army's brigade combat teams at a faster pace than the Bush Administration's 2009 plan would have (see Summary Figure 4), fulfilling the Chief of the Army's desire to get new technologies into the hands of soldiers. By 2020, the Army would purchase enough FCS components under this alternative to equip all of its combat brigades. But because quantities per brigade would be much

lower than those planned for the fully equipped FCS BCTs, the total number of FCS sensors and combat vehicles attached to the network would also be lower than under the Bush Administration's 2009 plan.

The fleet's average age would also remain relatively constant under this alternative—between 8 years and 12 years—because the Army would invest \$65 billion in upgrades from 2009 through 2030. By contrast, under the Bush Administration's 2009 plan, the average age of the "active" armored combat vehicle fleet (those vehicles that the Army needs to equip and support its forces) would have risen to more than 14 years in 2015 and then eventually declined, as FCS vehicles began to replace significant numbers of the older combat vehicles (see Summary Figure 4).

Summary Table 5.

Costs of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives, 2009 to 2030

(Billions of 2009 dollars)

	Research and Development	Procurement	Total Acquisition
Administration's Plan^a			
FCS Program ^b	14	103	117
FCS Spin-Out Program	*	18	18
Upgrades to Current Systems			
Explicitly included in the Administration's plan	1	8	9
CBO's estimate of additional upgrades included in the Administration's plan ^c	1	45	46
Total	16	173	189
Alternative 1. Emphasize Information Collection and Sharing			
FCS Components ^d	10	21	31
Upgrades to Current Systems ^c	2	63	65
Total	12	84	96
Alternative 2. Emphasize New Vehicular Technology			
FCS Components ^e	12	64	76
Upgrades to Current Systems ^c	2	55	57
Total	14	119	133
Alternative 3. Cancel the FCS Program (Except the network)			
Alternative 3A: Link All Combat Vehicles			
FCS network	9	32	41
Upgrades to current systems ^c	2	63	65
Total	11	95	106
Alternative 3B: Link a Fraction of Combat Vehicles			
FCS network	9	9	18
Upgrades to current systems ^c	2	63	65
Total	11	72	83

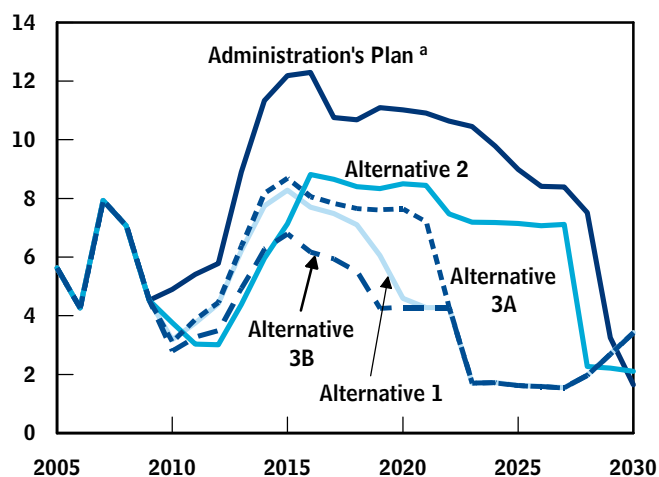
Source: Congressional Budget Office based on data from the Department of the Army.

Note: FCS = Future Combat Systems; * = less than \$500 million.

- Based on the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- Includes costs to develop and purchase 15 brigades' worth of FCS components—enough to equip almost 60 percent of the Army's planned 26 heavy brigades (19 brigades in the active Army and 7 brigades in the Army National Guard).
- Includes upgrades to Abrams tanks, Bradley fighting vehicles, and M109 howitzers to maintain a relatively constant average age for each fleet after 2013, and purchases of Stryker vehicles to replace M113-based vehicles.
- Includes unattended ground sensors, unmanned aerial vehicles (Classes I and IV), non-line-of-sight launch systems, small unmanned ground vehicles, and the network.
- Includes manned vehicles (command and control, medical, non-line-of-sight mortar, non-line-of-sight cannon, and infantry carrier) and the network.

Summary Figure 3.**Annual Costs of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives**

(Billions of 2009 dollars)



Source: Congressional Budget Office.

a. Includes CBO's estimates of costs of additional upgrades to and purchases of armored combat vehicles to maintain a relatively constant average age of the fleets after 2013.

One disadvantage of this alternative (when compared with the Bush Administration's 2009 plan) is that the Army would retain its full inventory of tanks, fighting vehicles, and self-propelled howitzers indefinitely. By 2030, therefore, some of those vehicles would have been in the Army's inventory for almost 50 years. A second disadvantage of this and all of the alternatives that CBO considered is that none of the BCTs would include the full complement of FCS technologies that the Army once argued was necessary to realize the system's full benefit.

Alternative 2. Emphasize Investment in New Manned Combat Vehicles

CBO estimates that costs under this alternative would exceed those under Alternative 1, totaling \$133 billion from 2009 through 2030. Of that amount, \$76 billion would be needed to develop the five variants of FCS manned vehicles and to purchase 26 BCTs' worth of equipment. Upgrading the armored vehicles retained under this alternative would cost \$57 billion from 2009 through 2030 (see Summary Table 5 on page xxi). Because purchases of large numbers of FCS manned vehicles would not begin until 2015 under this alternative,

the annual funding required through 2015 would be less than that required under the previous alternative or under the Bush Administration's 2009 plan (see Summary Figure 3). After 2015, annual costs for this alternative, at \$7 billion to \$9 billion, would be greater than those under the previous alternative through 2028 but still less than costs under the Bush Administration's 2009 plan.

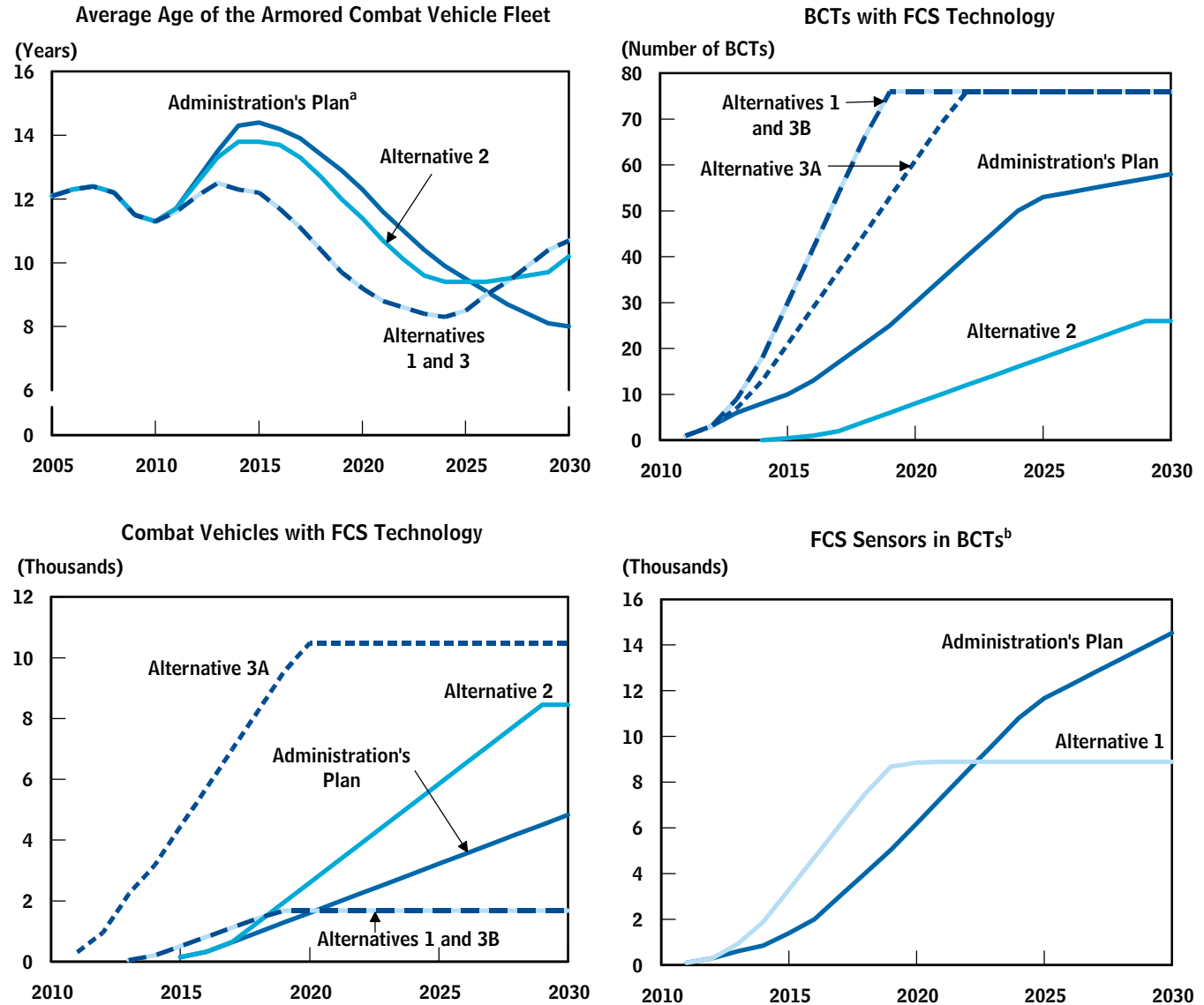
Among the approaches that CBO considered, Alternative 2 is unique in its introduction of new vehicular technology into the Army's forces. More new armored combat vehicles would be introduced annually and some of the Army's oldest armored vehicles would be retired earlier under this alternative than under any other—including the Bush Administration's 2009 plan. In addition, this alternative would modernize all of the Army's heavy BCTs with some FCS vehicles, and it would link more manned vehicles to the FCS-based network than would the Bush Administration's 2009 plan. However, this alternative would not upgrade the current vehicles remaining in the fleet as quickly as would the other alternatives. As a consequence, the average age of all armored vehicles in the active fleet under this alternative would be similar to that under the Bush Administration's 2009 plan (see Summary Figure 4).

Perhaps the most serious disadvantage of Alternative 2 is that it would do nothing to introduce FCS technologies into those brigade combat teams that contain no tracked combat vehicles, which make up the bulk of the Army's combat forces. Furthermore, it would forgo development and fielding of FCS sensors to any of the Army's BCTs. As with the other two alternatives that CBO examined, the Army under this alternative would indefinitely retain large numbers of Abrams tanks and Bradley fighting vehicles in its inventory.

Alternative 3. Cancel All Portions of the FCS Program Except the Network

CBO developed two versions of Alternative 3. One version, Alternative 3A, would equip roughly 300 vehicles in each brigade combat team with links to the FCS network. Alternative 3B would purchase far fewer links to the FCS network—84 per BCT—an amount equal to that envisioned in the Army's Spin-Out program.

The Army would purchase the least amount of hardware in variant 3B of this alternative, when compared with that purchased under the other alternatives, and would incur the lowest costs—\$83 billion from 2009 through

Summary Figure 4.**Comparison of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives**

Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; FCS = Future Combat Systems.

- a. Includes CBO's estimates of additional purchases of armored combat vehicles to maintain a relatively constant average age of the fleets after 2013.
- b. Includes unmanned aerial vehicles, unattended ground sensors, small unmanned ground vehicles, and armored robotic vehicles—assault-light. Under Alternatives 2 and 3, the Army would not purchase any FCS sensors.

2030. CBO estimates that \$18 billion of that total would be needed to develop and purchase the hardware for the FCS network; the other \$65 billion would be used to modernize the Army's existing armored combat vehicles (see Summary Table 5 on page xxi). The annual funding needed to implement Alternative 3B would be roughly \$4 billion to \$6 billion from 2013 to 2022 and \$2 billion to \$3 billion thereafter (see Summary Figure 3 on page xxii).

Alternative 3A, because it would purchase more network hardware per BCT than Alternative 3B, would also be more expensive. Its costs for FCS-related hardware would amount to \$41 billion from 2009 through 2030, or \$106 billion with the costs associated with combat vehicle upgrades and purchases included. Annual costs would be roughly \$8 billion from 2014 through 2021.

Both variants of Alternative 3 would introduce FCS technologies into the Army's brigade combat teams more quickly than the Bush Administration's 2009 plan would have (see Summary Figure 4 on page xxiii). Under both variants, each of the Army's BCTs would have some vehicles integrated into the FCS-based network by 2022, although the total number of vehicles under Alternative 3A would be nearly four times as large as that under Alternative 3B. But those vehicles would be able to receive information only from sensors that exist currently or from each other, because this alternative would cancel the development of all FCS sensors. And, even though the Army's fleets of tanks, fighting vehicles, and self-propelled howitzers would be connected by a new network and upgraded to keep them in working condition under this alternative, they would essentially be the same vehicles that the service has already had for more than 20 years.

Introduction and Background

For the past several years, the Army has been transforming itself from a force designed primarily to fight intense and relatively short wars in a predictable and limited number of locations after extensive preparation to one capable of reacting rapidly to crises anywhere in the world. In October 1999, then Chief of Staff General Eric Shinseki unveiled a vision of an Army that could deploy a fighting unit of 3,000 to 5,000 soldiers to any location around the world in 96 hours or less. To accomplish his goal, General Shinseki envisioned an Army equipped not with 70-ton tanks, but with much lighter vehicles that could be flown overseas in large numbers. Four years later, the new Army Chief of Staff, General Peter Schoomaker, also expressed a desire for a force that was quicker to deploy than the one he inherited, but his emphasis was more on changing how the Army's units are organized than on how they are equipped. General Schoomaker envisioned an Army that is divided into smaller units that are highly networked.

Those two leaders set in motion programs that the Army is still carrying out today and that will not be fully implemented for many years to come. General Shinseki's legacy—the Future Combat Systems (FCS) program—until recently aimed to replace the Army's current armored vehicles with new vehicles that were much lighter but equally as lethal and survivable as their predecessors. General Schoomaker's effort to reorganize the Army is known as the Modularity Initiative.¹ That program would convert the Army's forces from a structure based on divisions that include roughly 12,000 to more than 17,000 soldiers to one that is built around brigade combat teams (BCTs) made up of 3,400 to 4,000 personnel.

Those two efforts were begun in the first few years of this decade and will continue into the next. The Future Combat Systems program is a major modernization effort that, as of early 2009, would have developed and purchased 14 new weapon systems, including eight manned vehicles to replace the tanks and armored vehicles that currently equip the Army's armored forces.² Those vehicles would be much lighter than the armored vehicles currently in the Army's inventory, which would, the Army contended, make combat units equipped with FCS components easier to deploy. The Modularity Initiative would reorganize all of the Army's forces into standardized units. In the case of combat forces, those units would be smaller than the divisions that were the previous standard combat unit.³ General Schoomaker argued that breaking the Army into a greater number of smaller units would allow commanders to create forces suited to their needs by combining the appropriate mix of standardized units, rather than having to take a whole division, which might not include the right mix of capabilities.

The FCS program and the Modularity Initiative are the Army's primary transformational initiatives designed to provide both current and future capabilities and are, according to the Army, at the center of its efforts to meet the full spectrum of challenges that it faces now and will

1. In discussions of the Army, when a particular component is not specified—either the active Army, the Army National Guard, or the Army Reserve—this analysis refers to the Army as a whole.

2. In April 2009, Secretary of Defense Robert M. Gates announced a restructuring of the FCS program that would cancel the development and procurement of the FCS manned vehicles. Because no details of the restructured program were available prior to the publication of this study, the Congressional Budget Office analyzed the FCS program as it was defined in President Bush's 2009 budget request.

3. A division with roughly 15,000 soldiers had been the unit commonly used to describe the Army's force structure. It typically included three maneuver brigades. Brigade combat teams, each with 3,000 to 5,000 soldiers, were formed by combining one maneuver brigade with several support units from the division.

face in the future.⁴ Both initiatives require the investment of tens of billions of dollars, however. Those costs are one reason that defense experts have concerns about the initiatives. For the Modularity Initiative, costs have already more than doubled. For the FCS program, experts also question whether it is technically feasible and whether the benefits that could result from its implementation are worth the cost and risk.

This Congressional Budget Office (CBO) analysis examines the Army's FCS program and Modularity Initiative as they were structured in early 2009 and the concerns that have been raised about them.⁵ It first describes the two programs and their histories in detail and then assesses how the programs would affect the ability of the Army's forces to deploy overseas and how much it would cost to complete them. Finally, the analysis evaluates several alternatives to the FCS program that are designed to cost less and to accelerate the fielding of advanced technologies to the Army's combat forces.⁶

The Army's Modularity Initiative

In February 2004, the Army announced that it would restructure its combat forces to make them more agile and flexible. Until then, in the so-called premodular structure, most of the service's combat forces were organized into divisions that typically comprised three combat—or maneuver—brigades in addition to several support components such as engineer units, artillery units, and signal units.⁷

At the end of 2003, the Army's combat forces included 10 active divisions and 8 National Guard divisions as well as several brigade combat teams and regiments outside those divisions. That force structure, however, had not

been well-suited to some military operations conducted in the 1990s, particularly in Bosnia and Kosovo. Once the situation there had been stabilized and troops of the North Atlantic Treaty Organization had gained control, U.S. peacekeeping operations required less than a full division's worth of combat forces. As a result, one or two BCTs from a division would be deployed, along with a division headquarters and other support units, for what would typically be a six-month rotation. After that, another combat brigade or two and associated support units, often from a different division, would replace them. The Army found such reconfiguration of parts of divisions into smaller packages, or task forces, to be disruptive.

To create a more responsive and more easily deployable force, the Army began restructuring its organization in early 2004 from one based on 18 divisions, several of unique design, to one based on 70 brigade combat teams, each being one of only three designs. Since then, the Modularity Initiative has grown to include the restructuring and standardization of the Army's division and corps headquarters units as well as the support units assigned to the divisions and corps within its premodular structure.

The rest of this section will describe the Modularity Initiative in detail, changes in the program that have occurred since it was first conceived, the effects the program would have on the Army's force structure, and the program's costs.

Description of the Original Modularity Initiative

If carried out as planned, the Modularity Initiative will touch almost all aspects of the Army's force structure. Although the service will retain 18 division and three corps headquarters under the initiative, it will alter the units associated with them. Divisions, which were typically assigned three maneuver brigades in the premodular Army, will have four BCTs associated with them in the modular Army. Combat—or maneuver—brigades in the premodular Army comprised only combat units (such as infantry battalions and tank battalions). In the modular Army, however, BCTs will include some supporting units as well (such as artillery units and engineer units). According to the Army, those changes will enable each modular BCT to be more self-contained and thus to operate more effectively on its own. Because BCTs are

4. U.S. Army, *The Army Modular Force and Future Combat Systems Strategy* (Summer 2005).
5. Changes to the two programs proposed after early 2009, such as those announced by Secretary Gates in April 2009, will be noted. In the absence of details concerning those programs, however, CBO conducted its analysis of the Army's transformation programs as they were defined and described in the Bush Administration's 2009 plan.
6. One of those alternatives roughly approximates the restructured FCS program that Secretary Gates described in April 2009.
7. An exception to that structure was the 10th Mountain Division, which had only two combat brigades in 2003.

designed to be the basic unit for carrying out the Army's missions, the remainder of this discussion of the Modularity Initiative will focus primarily on changes to the Army's combat structure.

The original impetus for the Modularity Initiative was to provide field commanders with forces that were appropriate to their missions more quickly than was possible under the premodular structure. To accomplish that goal, General Peter Schoomaker envisioned three major changes: The brigade, rather than the division, would become the primary unit for deployments; the number of brigade-sized combat units available to sustain overseas operations would increase; and brigade-sized units would become more self-contained and self-supporting. To bring about those changes, the total number of brigade-sized combat units in the active Army was to increase by 10—from 33 to 43. Furthermore, each BCT, although typically still associated with a division, could be deployed on its own or could be assigned to a different division headquarters during an operation. Finally, each brigade-sized combat unit would include some support units—such as artillery units and reconnaissance teams—that were not specifically part of a maneuver brigade in the premodular Army.

Because combat brigades in the active Army had previously been organized primarily as parts of a division, the plan to create modular combat brigades was a break with long-standing practice. If less than a full division was sent out of the United States on a mission, parts of the division headquarters, a maneuver brigade, and subsets of other divisional units (such as the division artillery) would be sent as part of a task force. But under the Modularity Initiative, those types of ad hoc arrangements would be made permanent. In effect, instead of being composed of 10 divisions that each had three maneuver brigades, one artillery brigade, one engineer brigade, one aviation brigade, and numerous other units, the Army's force structure would be made up of 10 divisions that each had four BCTs, one aviation brigade, one sustainment brigade, and one headquarters unit (see Figure 1-1).⁸ Each brigade combat team would now include some engineers, some artillerymen, medics, quartermasters, scouts, and other support personnel formerly assigned to the division. In that way, Army leaders contend, each modular brigade combat team would be better able to support itself without additional division assets.

That original plan, as outlined in January 2004, included an ambitious schedule for reorganizing combat units in the active Army. It would have added 10 modular BCTs to the active Army by 2006 at a total cost of \$21 billion. All 10 of the additional BCTs were to be infantry BCTs (IBCTs) because they are the easiest to deploy and least expensive to equip. That original plan soon changed, however.

Changes in the Modularity Initiative

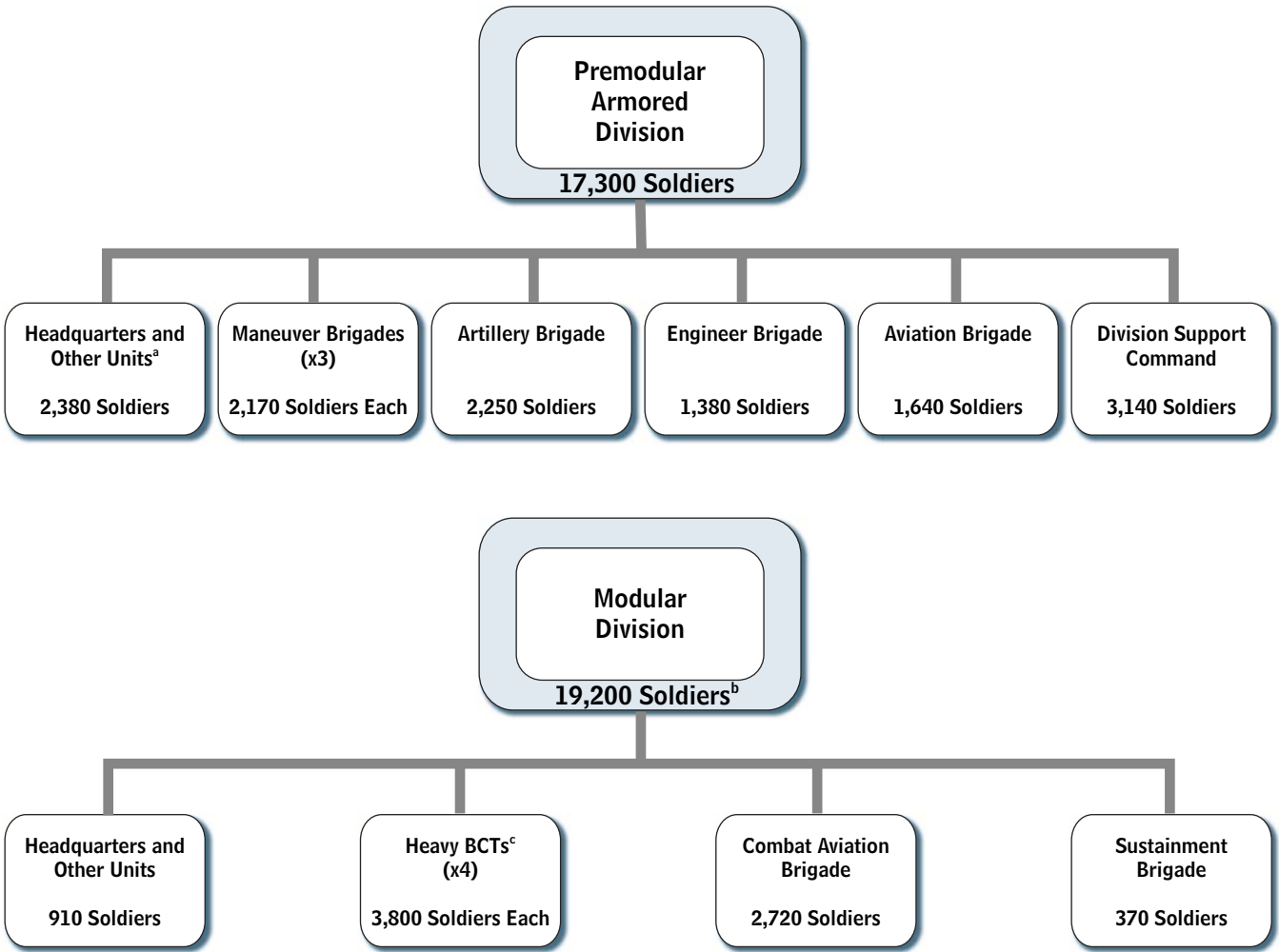
Since the initiative was conceived in early 2004, it has grown in scope, cost, and duration. A month after introducing the initiative, the Army added five BCTs to its plan to expand the active Army. That expansion added one year and \$3 billion to the program, delaying its completion until 2007 and raising the total cost to \$24 billion.

The next change in scope included a significant expansion. In November 2004, the Army decided that the reorganization would include combat units in the National Guard and support units. As a consequence, the Modularity Initiative as conceived at that time would have yielded a total of 77 BCTs—43 in the active Army and 34 in the National Guard—as well as an unspecified number of support units in all three components of the Army (active, National Guard, and Reserve). That expansion caused more than a doubling in price, to \$52 billion, and a delay in completion until 2010 (see Figure 1-2).

A slight modification in March 2006 reduced the number of BCTs in the active Army to 42 and the number to be retained in the National Guard from 34 to 28. The total estimated cost for the initiative rose to \$55 billion, however, because by that time, the Army had gained a better understanding of the costs associated with carrying out all the elements of its reorganization.

8. A sustainment brigade performs support functions for an entire division—such as financial accounting, management of human resources, and provision of selected types of medical care—that are not performed by the support units now included in the modular BCTs. For a complete discussion of the changes resulting from the Army's initiative, see U.S. Army Training and Doctrine Command, *Army Comprehensive Guide to Modularity*, vol. 1, version 1.0 (October 8, 2004); and Congressional Budget Office, *Options for Restructuring the Army* (May 2005).

Figure 1-1.
Comparison of the Army’s Premodular and Modular Divisions



Source: Congressional Budget Office based on information from the Department of the Army’s WEBTAADS database (an Internet version of the Army Authorization Document System, or TAADS, maintained by the Army Force Management Support Agency’s Requirements Division) and Military Traffic Management Command Transportation Engineering Agency, *Deployment Planning Guide: Transportation Assets Required for Deployment*, MTMCTEA Pamphlet 700-5 (May 2001).

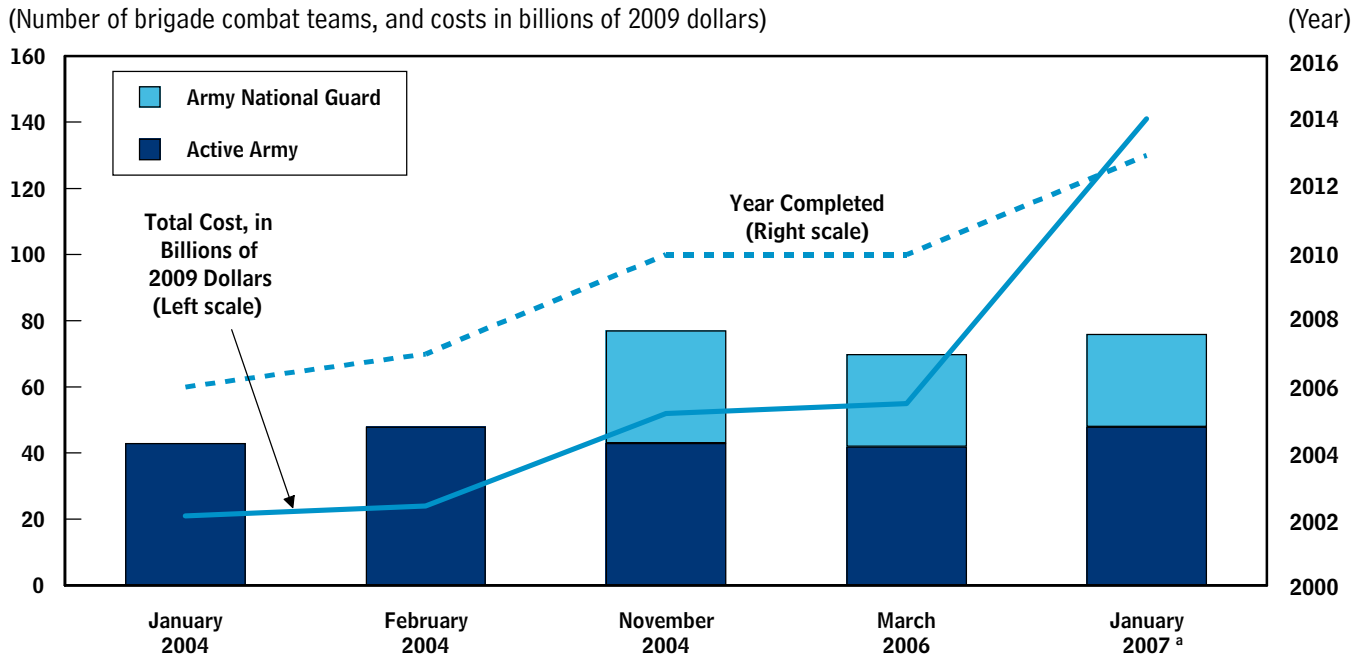
a. Includes air defense, signal, military intelligence, military police, and chemical units.

b. Based on the 1st Cavalry Division.

c. A brigade combat team, or BCT, includes artillery, signal, military intelligence, military police, and medical units.

Figure 1-2.

Plans for Modular Brigade Combat Teams and Estimates of Modularity Costs Through 2013 Under the Previous Administration's 2009 Plan



Source: Congressional Budget Office based on Government Accountability Office, *Force Structure: Better Management Controls Are Needed to Oversee the Army's Modular Force and Expansion Initiatives and Improve Accountability for Results*, GAO-08-145 (December 2007), p. 18; and Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and Marine Corps's Personnel Levels," letter to the Honorable Carl Levin (April 16, 2007).

a. Includes the addition of 74,200 personnel, six brigade combat teams, and several support units to the total Army.

Another change to the program occurred in January 2007, when the Army announced that it would expand the size of the total Army by 74,200 personnel from what it was at the end of 2004 and add six BCTs to the active Army.⁹ (This is the program supported by the previous Administration's 2009 plan; it is also the one that CBO analyzed and is the subject of the rest of the discussion.) Because that increase in the number of combat teams included the addition of personnel, the costs to implement that change alone—the so-called Grow the Army (GTA) initiative—are substantial, at \$74 billion through 2013, in CBO's estimation.¹⁰ At that time, the Army also indicated that it might not complete its originally

planned reorganization of its existing force structure before 2013 and that additional costs might be incurred in 2012 and 2013. That delay pushed up costs for the original Modularity Initiative to an estimated \$67 billion. Combining the \$74 billion in costs for growth in the Army with the \$67 billion for the original Modularity Initiative more than doubles the total cost of modularity through 2013, to more than \$140 billion—almost a six-fold increase over the original estimate.

Description of the Modularity Initiative Included in the Bush Administration's 2009 Plan

The Army's modularity plan, as outlined in its February 2008 annual report to the Congress, would yield a force structure in 2013 consisting of 76 brigade combat teams

9. That increase, relative to the end strengths authorized for the end of 2004, added 65,000 personnel, 8,200 personnel, and 1,000 personnel to the active Army, National Guard, and Army Reserve, respectively. It is unlikely that the Army could have supported a modular force structure of 42 active-duty BCTs without increasing the size of the active-duty force. See Chapter 2 for a detailed discussion of personnel requirements of the modular force.

10. See Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and the Marine Corps's Personnel Levels," letter to the Honorable Carl Levin (April 16, 2007).

Table 1-1.

Changes in the Number of the Army's Combat Brigades Under the Previous Administration's Modularity Initiative, 2003 to 2013

	2003 ^a	2013 ^b	Change, 2003-2013
Active Army			
Infantry	11 ^c	23	12
Heavy	20	19	-1
Stryker	2	6	4
Subtotal	33	48^d	15
Army National Guard			
Infantry	10 ^c	20	10
Heavy	28	7	-21
Stryker	0	1	1
Subtotal	38	28	-10
Total Army			
Infantry	21 ^c	43	22
Heavy	48	26	-22
Stryker	2	7	5
Total	71	76	5

Source: Congressional Budget Office based on data from the Department of the Army.

Note: The Army Reserve has no combat brigades.

- Includes maneuver brigades in divisions, separate combat brigades, and armored cavalry regiments.
- Includes all 76 brigade combat teams (BCTs) in the Army's plans at the end of 2008.
- These types of brigades—light infantry, airborne, and assault—include very few, if any, armored vehicles.
- Secretary of Defense Robert M. Gates announced in April 2009 that the active Army would grow to 45 BCTs by 2013.

and more than 220 support brigades.¹¹ Most of the teams would be in the active Army (48 out of a total of

76); the remainder would be in the Army National Guard.¹² The support brigades would be distributed more evenly among the three components, with 83 in the active Army, 84 in the Guard, and 60 in the Reserve. The Army is still defining the detailed structure of its support brigades, including how they will be staffed and equipped. For that reason, and because most debate concerning the Army's forces pertains to its combat units, the rest of this analysis of the Modularity Initiative and its effects will focus on the Army's BCTs.

When completed in 2013, the conversion of the Army's combat force structure from its premodular state in 2003 to the modular design will have shifted a majority of the combat units from the National Guard to the active Army and from heavy to light—or infantry—units (see Table 1-1 and Figure 1-3). In 2003, more than two-thirds of the Army's maneuver brigades—48 out of 71—included some tanks. And more than half of the 71 maneuver brigades were in the National Guard, although some analysts would argue that only 60 percent of those brigades were sufficiently equipped and trained to be used in combat.¹³ After the Army has completed its conversion to a modular structure, it will have more light BCTs than heavy BCTs (HBCTs), and almost two-thirds of the BCTs will be in the active Army. Finally, the combat structure in the National Guard, which had been composed of predominately heavy units in 2003, will shift to being dominated by infantry units in 2013.

Since 2003, the Army has been creating several combat units that can be described as “medium weight.” Those units are not equipped with tanks and armored personnel carriers but instead have Stryker vehicles (which are armored vehicles with wheels). In general, the armored vehicles in heavy units are equipped with tracks similar to those on heavy construction equipment. Those so-called tracked vehicles can traverse most kinds of terrain and are hard to defeat with most weapons. Because of their weight, however, they are generally fuel inefficient and can be damaging to roads and closely packed urban dwellings. In contrast, wheeled armored vehicles (such as the Stryker) typically weigh less and are more fuel efficient. The Army created Stryker units in the hope that they would be easier to deploy overseas than heavy units

11. In April 2009, Secretary Gates announced that the Army would increase its force structure to 73 brigade combat teams, rather than the 76 brigade combat teams included in the 2009 plan. Under that amended plan, the active Army will include 45 brigade combat teams when the initiative is complete, rather than the 48 included in the 2009 plan. CBO's analysis, and the rest of the discussion in this study, addresses the Modularity Initiative as it was described in the Army's February 2008 report to the Congress, not as amended by Secretary Gates in April 2009.

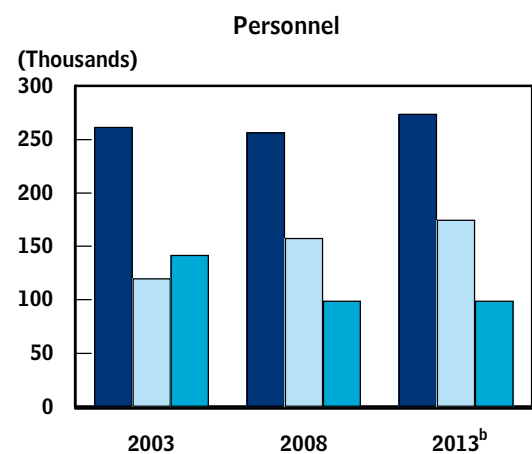
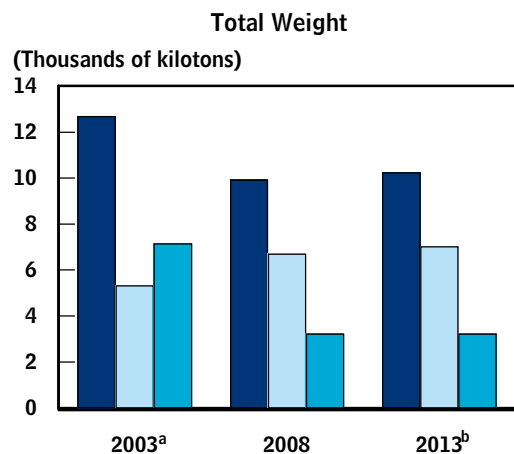
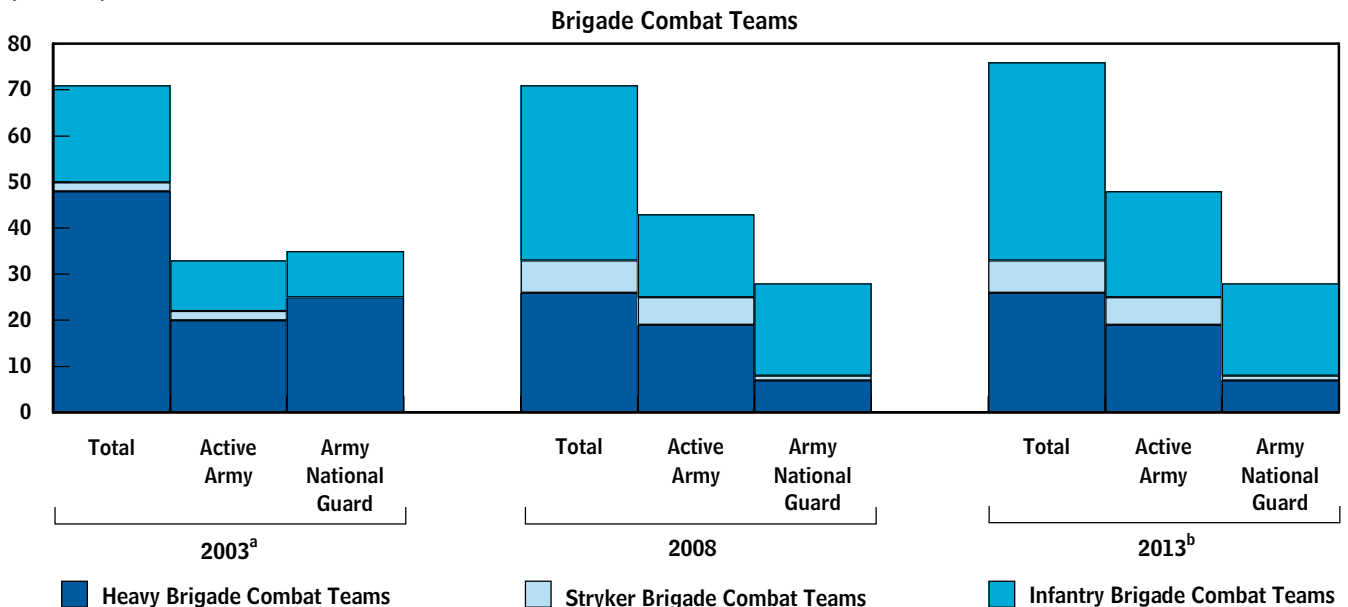
12. There are no combat brigades in the Army Reserve.

13. See Congressional Budget Office, *Options for Restructuring the Army*, pp. 5–6.

Figure 1-3.

Changes in the Army's Brigade Combat Teams Under the Previous Administration's 2009 Plan, 2003 to 2013

(Number)



Source: Congressional Budget Office based on data from the Department of the Army.

Note: The Army Reserve includes no brigade combat teams.

- a. A brigade combat team in 2003 was composed of one maneuver brigade and additional support units
- b. Does not reflect Secretary of Defense Robert M. Gates's announcement in April 2009 that the active Army would grow to a total of 45 brigade combat teams rather than the 48 included in the previous Administration's 2009 plan.

Table 1-2.

Comparison of Selected Features of the Army's Premodular and Modular Brigade Combat Teams

Type of Brigade Combat Team		Equipment		Total Weight (Tons)
		Armored Vehicles ^a	Trucks ^a	
Premodular ^b				
Infantry				
Light	2,700	0	420	2,900
Airborne	3,100	0	570	4,200
Heavy	3,800	450	840	25,000
Modular				
Infantry	3,400	*	1,000	7,400
Heavy	3,800	350	950	22,800
Stryker	3,900	320	700	14,900

Source: Congressional Budget Office based on Military Traffic Management Command Transportation Engineering Agency, *Deployment Planning Guide: Transportation Assets Required for Deployment*, MTMCTEA Pamphlet 700-5 (May 2001); and data from the Department of the Army.

Note: * = fewer than 5 vehicles.

a. Rounded to the nearest 10 vehicles.

b. Premodular brigade combat teams are composed of several divisional units including one maneuver brigade and several supporting units. Not all types of premodular brigades are included in the table.

and would be more mobile than light infantry units once they arrived in-theater. Stryker units have proved useful in operations in Iraq, offering better communications and more mobility than other types of units. Nevertheless, even when the Army's restructuring is complete, the planned seven Stryker brigade combat teams (SBCTs) will make up less than 10 percent of the Army's total combat units (see Table 1-1 on page 6).

Effects of the Modularity Initiative on the Army's Combat Force Structure

By the end of 2008, the Army had converted half of its BCTs to the modular configuration, and it will finish converting the remainder by 2013. The planned reorganization of the Army's force structure will change the balance between light and heavy combat brigades in the Army as well as the balance between brigades in the active Army and those in the National Guard.¹⁴

As modularity proceeds, the total number of brigade-sized combat units in the Army will rise, as will the number of brigade-sized combat units in the active Army. To compensate, the number of BCTs in the Guard will decline (see Figure 1-3 on page 7). The mix of heavy, Stryker, and infantry combat brigades will also change, as the number of heavy combat brigades declines significantly and the number of infantry combat brigades grows. As a result, the total weight of equipment associated with the Army's BCTs will decrease—especially in the National Guard. (Based on the 2009 plan that included a total of 48 BCTs in the active Army, the total weight of BCTs in the active Army will increase slightly between 2003 and 2013.) Trends in the number of personnel assigned to BCTs are similar, although not as dramatic. An increase in personnel assigned to active Army BCTs would be offset by a slightly smaller reduction in personnel in BCTs in the Guard. As a result, the number of personnel assigned to BCTs in the Army as a whole should remain relatively constant through 2013.

Those trends can be explained in part by the characteristics of the various types of BCTs currently in the Army, specifically their relative weights and staffing. In both the modular and premodular designs, HBCTs weigh roughly 200 percent more than IBCTs (see Table 1-2). As part of the Modularity Initiative, the Army will reduce its number of HBCTs by more than half, decreasing the total weight of HBCTs by roughly the same amount, a change that is largely reflected in the National Guard. At the same time, the new modular IBCTs will weigh more than the Army's premodular infantry BCTs. The addition of vehicles—and weight—to the infantry brigade combat teams, coupled with an increase in the total number of BCTs, results in an increase in the total weight associated with BCTs in the active Army.

In contrast, the number of personnel assigned to brigades does not vary drastically between types of units. The restructuring of the combat forces, even with the addition of five BCTs from 2003 to 2013, will not significantly boost the number of people assigned to BCTs over that period.¹⁵ Because the absolute number of BCTs in the

14. When referring to the Army's modular BCTs, the terms "brigade" and "BCT" will be used interchangeably.

15. That result will remain essentially unchanged even if the number of BCTs increases to 73, as envisioned by Secretary Gates in April 2009, rather than the 76 envisioned in the 2009 plan.

Table 1-3.
Costs of the Army's Modularity Initiative Under the Previous Administration's 2009 Plan

(Billions of 2009 dollars)

	Through 2008	2009 to 2013	Total
Modularity ^a			
Operation and maintenance	2	2	4
Procurement	24	34 ^b	58
Construction	1	4	5
Subtotal	27	40	67
Grow the Army ^c			
Personnel	6	25	31
Operation and maintenance	3	15	18
Procurement	4	10	14
Construction	2	9	11
Subtotal	15	59	74
Total	42	99	141

Source: Congressional Budget Office based on Government Accountability Office, *Force Structure: Better Management Controls Are Needed to Oversee the Army's Modular Force and Expansion Initiatives and Improve Accountability for Results*, GAO-08-145 (December 2007), p. 18; and Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and Marine Corps's Personnel Levels," letter to the Honorable Carl Levin (April 16, 2007).

Note: Operation and maintenance funds pay for training and sustainment. Procurement funds pay for equipment.

- a. Based on the Army's estimated costs as of January 2007 totaling \$53 billion from 2005 to 2011.
- b. Includes \$21 billion for 2009 to 2011. The Army has not identified costs for 2012 and 2013. The estimate is based on annual costs in 2012 and 2013 of \$6.5 billion, which is roughly the average of spending planned for 2010 and 2011.
- c. Does not reflect changes announced by Secretary of Defense Robert M. Gates in April 2009 limiting the growth of the active Army to three brigade combat teams rather than the six in the 2009 plan.

active Army is scheduled to increase by 15 under the 2009 plan, however, the total number of personnel assigned to those units will also rise. In the Guard, the number of BCTs will decrease by 10, and the number of personnel will decline by more than 40,000.

Funds for the Modularity Initiative

The Army has received significant funds specifically for its Modularity Initiative and has indicated that it will need additional funds to complete it. According to the Army, it received \$27 billion from 2005 through 2008 to carry out the initiative. Most of those funds—\$24 billion—have been used to buy equipment for the newly formed or reconfigured units. The remainder of the funds have paid for training personnel, operating and maintaining the units, and for building new facilities. Additional funds have been used to increase the size of the Army to form new modular units. Funds provided for that Grow the Army part of modularity totaled \$15 billion through 2008: \$6 billion for additional personnel; \$4 billion for equipment; and the remainder for training, operations, and facilities (see Table 1-3).

Estimates of the costs from 2009 through 2013 to complete the Modularity Initiative, including efforts to Grow the Army, could approach \$100 billion. The largest component of those costs—\$44 billion, CBO estimates—would be for equipment for the six new BCTs that the Army planned to add in early 2009 as well as for newly reconfigured units.¹⁶ CBO estimates that \$25 billion would be needed to pay for the additional personnel costs associated with the GTA initiative from 2009 through 2013. Finally, an additional \$17 billion would be needed to train, operate, and maintain the units, and \$13 billion would be needed to build facilities for the new units and housing for the additional personnel over that period. The total cost for modularization from 2009 through 2013 could reach \$99 billion, in CBO's estimation (see Table 1-3).

The Army's Future Combat Systems Program

Although the Army's Modularity Initiative is designed to make its combat forces more flexible and responsive, it will not enable them to deploy more quickly to remote trouble spots, CBO concludes. The equipment proposed

16. CBO's estimate for the costs of equipping the six new BCTs—\$10 billion—is explained in Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and the Marine Corps's Personnel Levels." The costs to finish equipping the remainder of the modular units is based on the Army's estimates of the funding required for 2009 through 2011 and continued funding in 2012 and 2013 at \$6.5 billion, roughly equal to the average funding planned for 2010 and 2011.

for modular brigade combat teams will weigh almost as much as, and in some case more than, the equipment associated with typically equipped premodular BCTs of the same type. Therefore, transporting a modular heavy brigade combat team will require the same amount and types of equipment as are needed to move a typical premodular HBCT.¹⁷

To address those obstacles to rapid deployment, the Army initiated the Future Combat Systems program, which it regards as the cornerstone of its efforts to transform itself into the kind of force needed in today's national security environment. The program, as envisioned by the Army and supported by the previous Administration's 2009 plan, would have developed the next generation of combat vehicles to be as lethal and survivable as current weapons but to weigh much less and require far less fuel and other logistics support. The program, as originally conceived in October 1999, would have developed eight new manned armored vehicles as well as four classes of unmanned aerial vehicles (UAVs), three types of unmanned ground vehicles (UGVs, or robots), unattended ground sensors (UGSs), an intelligent munition system, and a missile launcher, all of which would be linked by an advanced communications network into an integrated combat system. Although the program has changed over the years, it still remains an ambitious effort designed to totally transform the way Army brigades conduct warfare.

The Original FCS Program and Subsequent Changes

Despite the wide diversity that characterizes the individual components that make up the FCS program, the Army initially planned to develop and field all of them in concert. Thus, purchases are measured in terms of a brigade's worth of all types of FCS components in the program. As described by then Army Chief of Staff General Eric Shinseki in October 1999 and laid out in an FCS program briefing in November 2002, the program would have included a short (three-year) systems development phase starting in the spring of 2003. All 18 components included in the program at that time were to enter production by 2006 and start initial fielding in 2008.¹⁸ An ambitious procurement program would then follow, with

annual purchases of three brigades' worth of FCS components. At that rate, General Shinseki predicted, the entire Army—at that time, 65 BCTs—could be equipped with FCS components by 2032.

Changes in Schedule and Content. The ambitious schedule and complex content of the original FCS program necessitated several changes to the program since its inception. As the program approached the beginning of its development phase in the spring of 2003, the difficulty of meeting the ambitious schedule that General Shinseki had laid out became apparent. As a result, by April 2003, the length of the development phase had been extended, a decision about when to begin production had been delayed, and the fielding of the first brigade's worth of equipment was pushed back three years, to 2011. In addition, the rate of procurement was reduced to two brigades' worth of FCS components per year. At that rate, equipping the first 15 brigades would be delayed from 2015 (under the original schedule) to 2020.

Another schedule change resulted from a restructuring of the program in July 2004, in which the Army introduced a new concept that took into account (to some extent) the different levels of technical readiness of the various components.¹⁹ That restructuring extended the development phase by almost four years and introduced testing of the various components in four phases—the Army calls them spirals, or spin-outs—as they were developed. (A more detailed description of the current Spin-Out program is included later in this chapter.) By 2014, all of the FCS components, including all eight of the manned vehicles, would have been tested by an experimental unit staffed by soldiers. In that way, the least technologically challenging components of the program would be introduced to soldiers earlier, and development of the more difficult systems could be deferred until later. That

17. For details of CBO's analysis of the time needed to move an FCS brigade from the continental United States to locations overseas, see Congressional Budget Office, *The Army's Future Combat Systems Program and Alternatives* (August 2006).

18. Briefing by the Army's Future Combat Systems Team Program Review Board (November 12, 2002).

19. Statement of Paul L. Francis, Director, Acquisition and Sourcing Management, Government Accountability Office, before the Subcommittee on AirLand of the Senate Committee on Armed Services, *Future Combat Systems: Challenges and Prospects for Success*, published as Government Accountability Office, *Defense Acquisitions: Future Combat Systems—Challenges and Prospects for Success*, GAO-05-442T (March 16, 2005); and Congressional Research Service, *The Army's Future Combat System (FCS): Background and Issues for Congress*, RL32888 (April 28, 2005).

approach pushed the fielding of the first brigade equipped with all 18 FCS components to 2015. After that, as outlined in the Selected Acquisition Report (SAR) submitted to the Congress in December 2004, the Army planned to equip its BCTs with the full complement of systems at a maximum rate of two BCTs per year.²⁰ Under that schedule, 15 brigades would be equipped with all FCS components by 2022.

Nine months later, the September 2005 SAR showed that the schedule had changed once again, and the Army's maximum rate of procuring FCS components had dropped to 1.5 brigades' worth per year. At that rate, the Army would have only six FCS-equipped brigades in the field in 2020, and it would be 2025 before it completed the fielding of 15 FCS-equipped brigades.

Slightly more than one year later, the program was modified again. Four of the 18 systems—including two classes of UAVs, one type of UGV, and the intelligent munition system—had been deferred from the initial fielding or dropped from the program. In addition, the schedule for fielding FCS brigades was extended. As reported in the most recent SAR (December 31, 2007), the program would buy a maximum of one brigade's worth of FCS components per year, thereby delaying the fielding of the 15th and last FCS brigade combat team until 2030.

In April 2009, Secretary Gates announced a restructuring of the FCS program. He proposed canceling the development and procurement of the manned vehicles in the FCS program and increasing the rate at which other FCS components were introduced into existing types of modular units. No details of the restructured program were available prior to the publication of this study, however. Therefore, CBO analyzed the FCS program as it was defined in President Bush's 2009 budget request. All subsequent discussions of the program will refer to the version that was supported by the previous Administration's 2009 plan and described in the December 2007 Selected Acquisition Report.

20. The Army must submit annual reports to the Congress for any defense acquisition programs that could eventually require a total expenditure of \$365 million for research, development, testing, and evaluation or \$2.190 billion for procurement (in 2000 dollars). Those Selected Acquisition Reports provide details on the schedule and plan for the program and the anticipated total research and development and procurement funding needed to carry it out.

Changes in Estimated Costs. The FCS program has experienced a significant increase in costs since it entered the development phase in the spring of 2003. At that time, the Army estimated that \$87 billion would be needed through 2020 to develop and purchase the FCS network and all 18 components (except the recovery and maintenance vehicle) in quantities sufficient to equip 15 brigades. In the December 2004 SAR, the program's estimated costs over the same period had risen to \$91 billion despite plans that reduced the scope of the effort to 14 components and the network, and delayed the fielding of the first FCS brigade by one year.

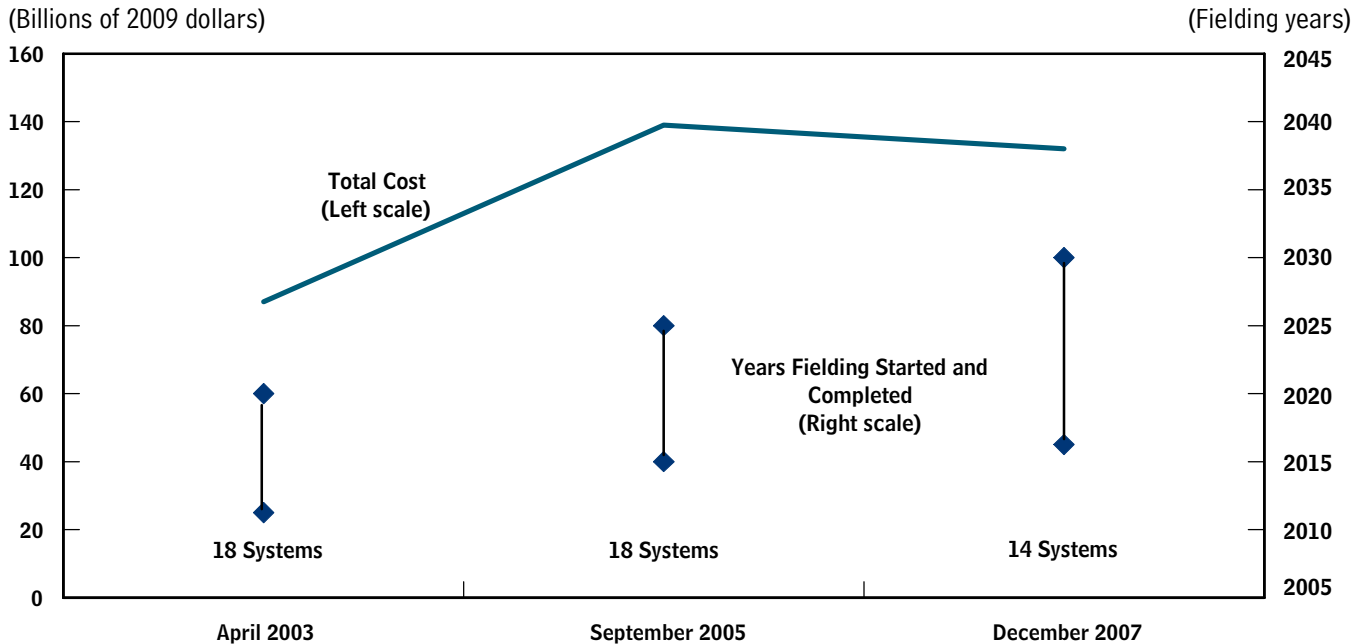
In September 2005, the Army announced that the cost through 2025 of developing and procuring all 18 components and the network for the first 15 brigades had increased to \$139 billion, which is 60 percent greater than the original estimate of \$87 billion. According to the December 2007 SAR, the total cost to develop and procure 15 brigades' worth of FCS components has decreased slightly, to \$132 billion.²¹ But the latest estimate covers the development and procurement of four fewer systems than the two previous estimates covered and extends through 2030 (see Figure 1-4).

Description of Systems in the FCS Program in the Previous Administration's 2009 Plan

The program included in the previous Administration's 2009 plan would have developed and procured manned vehicles, unmanned ground and aerial vehicles, various unattended sensors and missile launchers, and a network to tie them all together. In the past, each of the 14 components would have been developed and procured independently. The Army, however, insists that the full benefit of the FCS program will not be realized unless all of the components are fielded together and linked by the network. This section describes each component.

Manned FCS Vehicles. The eight types of manned FCS vehicles that the Army planned to develop were intended to replace the armored vehicles currently in its HBCTs. (The design of those existing vehicles—including Abrams tanks, Bradley fighting vehicles, M113-based vehicles,

21. No official reports concerning details related to changes in the program have been released with the submission of the fiscal year 2010 budget. All costs of the FCS program in this paper, therefore, are based on those in the December 2007 Selected Acquisition Report.

Figure 1-4.**Evolution of Plans for the Future Combat Systems Program Under the Previous Administration's 2009 Plan**

Source: Congressional Budget Office based on Office of the Secretary of Defense, *Future Combat Systems: Selected Acquisition Reports* (September 2005 and December 31, 2007); and data from the Department of the Army.

and M109 Paladin howitzers—dates to before 1980; moreover, especially in the case of the Abrams tank, the vehicles are very heavy and difficult to transport.)²² The new vehicles would have shared a common chassis, engine, and other parts and would have been much lighter and more fuel efficient than current armored vehicles. The Army argued that the common design would have reduced the logistics burden—in terms of spare and replacement parts and tools needed—associated with maintaining the vehicles and that their relatively greater fuel efficiency should have lessened the amount of refueling equipment required on the battlefield.

The Army initially aimed to develop FCS vehicles that would have weighed less than 20 tons and thus could have been transported by the Air Force's large fleet of C-130 aircraft. Although that weight may still have been

the ultimate goal, an Army briefing from January 2008 referred to manned ground vehicles weighing 27 tons.²³ But to meet even that less constraining goal, FCS vehicles would not have been able to rely on heavy armor for protection. (Vehicles equipped with heavy armor weigh more—sometimes far more—than 27 tons: The Abrams tank weighs 70 tons or more, and Bradley fighting vehicles and M109 self-propelled howitzers weigh 30 tons to 35 tons.) Instead, FCS vehicles, as envisioned by the Army, would have relied on knowledge of the enemy's whereabouts to avoid attacks and on active systems of protection to detect and neutralize incoming rounds to help them survive.

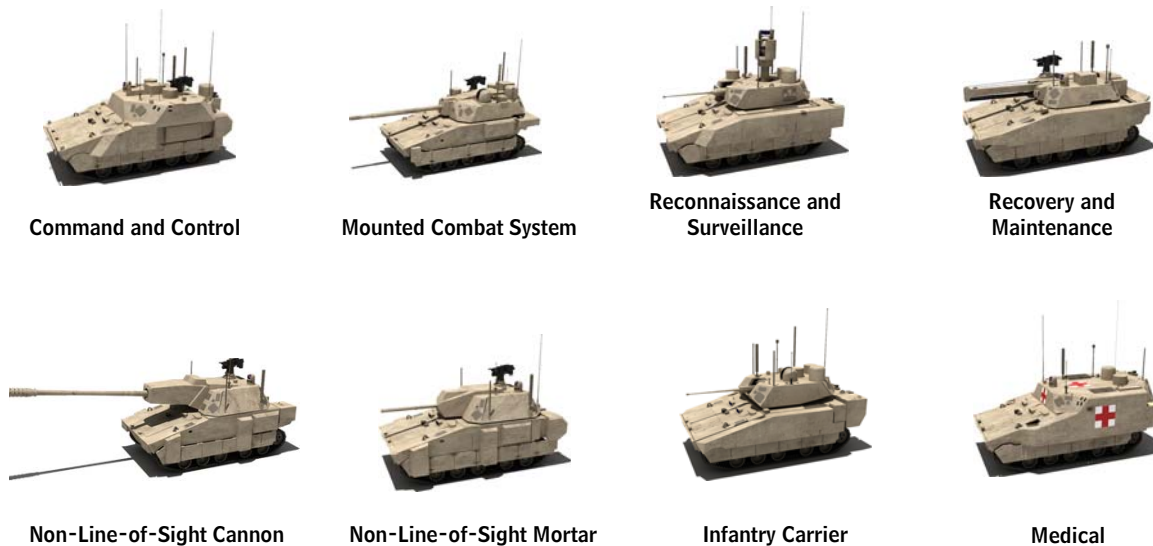
The manned vehicles in the FCS program as of early 2009 included seven variants that would have replaced all types of armored vehicles now in the Army's heavy units and one variant that had no current counterpart (see Figure 1-5).

22. See Congressional Budget Office, *The Army's Future Combat Systems Program and Alternatives*, for a detailed examination of the Army's armored combat vehicles and a more comprehensive description of each FCS component. That analysis explains the improvement in capability that the Army expects the FCS vehicles to provide, compared with their current counterparts.

23. Unpublished briefing, Col. Paul M. Crawford, "Army Modernization," January 2008. More recent unofficial Army documents refer to manned ground vehicles weighing 30 tons or more.

Figure 1-5.

Manned Vehicles in the Future Combat Systems Program Under the Previous Administration's 2009 Plan



Source: Congressional Budget Office based on information from the Department of the Army.

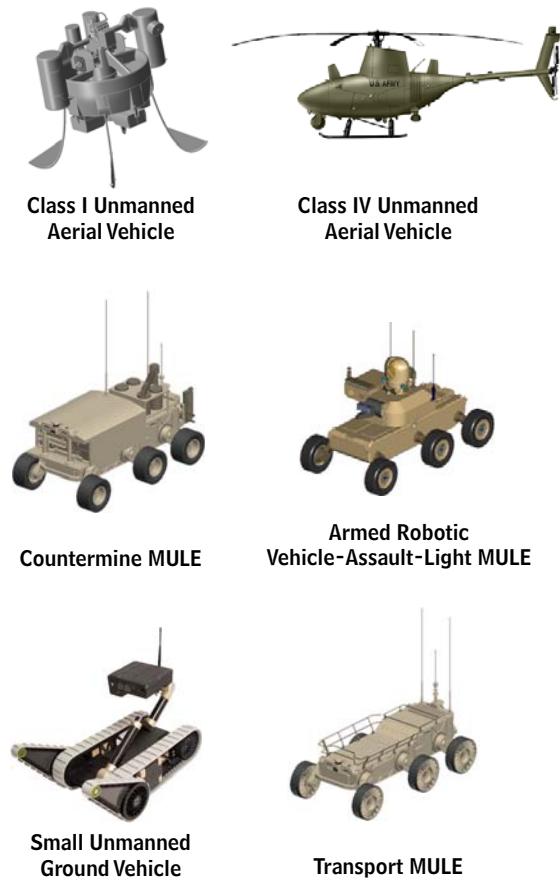
Note: Depictions of systems are not to scale.

- The mounted combat system (MCS) would have replaced the Abrams tank and—at 27 tons—weighed 40 percent as much.
- The infantry carrier vehicle (ICV) was being designed to carry up to nine soldiers and two crew members and would have replaced some Bradley fighting vehicles and M113-based armored personnel carriers in the current fleet. Compared with the most modern versions of the Bradley, a 27-ton ICV would have been almost 20 percent lighter, but it would have been nearly twice as heavy as the M113-based armored personnel carriers that it would have replaced.
- The non-line-of-sight mortar (NLOS-M) would have fired precision-guided mortar rounds and would have replaced the current M113-based mortar carrier.
- The non-line-of-sight cannon was designed to provide long-range fire support to combat battalions and would have replaced the M109 self-propelled howitzers in BCTs.
- The reconnaissance and surveillance vehicle would have featured a suite of advanced sensors to locate and identify enemy targets in all weather conditions, day or night, and would have replaced Bradley fighting vehicles that perform the same mission.
- The command-and-control vehicle would have provided commanders with the information and communications capability needed to manage their forces. It would have replaced the current M113-based command-and-control vehicle.
- The medical vehicle (MedV), which was designed to provide advanced life support to critically injured soldiers being evacuated from the battlefield, had no existing counterpart that has been fielded in the Army's BCTs.
- The recovery and maintenance vehicle was being designed to transport repair crews around the battlefield and to recover disabled vehicles. At 27 tons, it would have weighed 60 percent less than the M88A2 recovery vehicle it would have replaced in the Army's current combat units.

Unmanned Aerial and Ground Vehicles. The FCS program would develop two classes of unmanned aerial vehicles to carry out surveillance, identify targets, and relay communications to the units that the UAVs support.

Figure 1-6.

Unmanned Aerial and Ground Vehicles in the Future Combat Systems Program



Source: Congressional Budget Office based on information from the Department of the Army.

Notes: MULE = multifunctional utility/logistics and equipment.

Depictions of systems are not to scale.

According to current designs, the two classes would vary by range and time aloft (see Figure 1-6).

- Class I UAVs will provide information to the individual soldier. The Army's current descriptions specify that the system will weigh less than 51 pounds (including ground support equipment), be able to take off and land vertically, have a range of 8 kilometers (km), and be able to stay aloft for 50 minutes.
- Class IV UAVs, which are designed to support brigade commanders, could weigh more than 3,000 pounds and be as long as 23 feet. The UAV could operate in

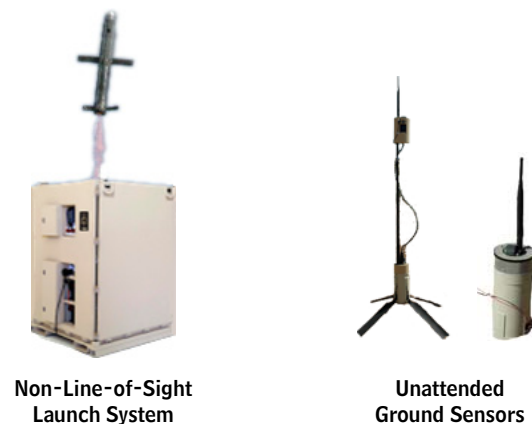
tandem with Army helicopters and would be able to relay communications for as long as five hours and provide reconnaissance, early warning, and surveillance from distances up to 75 km.

Two types of unmanned ground vehicles are also included in the FCS program (see Figure 1-6). In general, those vehicles are designed to lighten the loads of individual soldiers by performing continuous surveillance, carrying supplies, or entering areas of high risk.

- Current designs call for the multifunctional utility/logistics and equipment (MULE) vehicle—a 3.5 ton robot—to be built in three variants. The transport version would carry 1,900 pounds of soldiers' equipment; the countermine MULE would detect, mark, and defuse mines; and the armed robotic vehicle-assault-light (ARV-A-L), which would be equipped with sensors, communications equipment, and a machine gun, would provide cover for soldiers.
- The small unmanned ground vehicle (SUGV) is a robot designed to weigh less than 30 pounds and be transported by a soldier. Able to carry as much as four pounds of equipment—typically electronic sensors—the SUGV will be used to investigate caves, tunnels, buildings, or other potentially dangerous places.

Figure 1-7.

Other Unmanned Systems in the Future Combat Systems Program



Source: Congressional Budget Office based on information from the Department of the Army.

Note: Depictions of systems are not to scale.

Table 1-4.

Comparison of the Army's Premodular, Modular, and FCS Brigade Combat Teams

Type of Brigade Combat Team		Equipment		Total Weight (Tons)
		Armored Vehicles ^a	Trucks ^a	
Premodular ^b				
Infantry				
Light	2,700	0	420	2,900
Airborne	3,100	0	570	4,200
Heavy	3,800	450	840	25,000
Modular				
Infantry	3,400	*	1,000	7,400
Heavy	3,800	350	950	22,800
Stryker	3,900	320	700	14,900
FCS ^c	3,300	320	700 ^d	21,800

Source: Congressional Budget Office based on Military Traffic Management Command Transportation Engineering Agency, *Deployment Planning Guide: Transportation Assets Required for Deployment*, MTMCTEA Pamphlet 700-5 (May 2001); and data from the Department of the Army.

Note: FCS = Future Combat Systems; * = fewer than 5 vehicles.

- a. Rounded to the nearest 10 vehicles.
- b. Premodular brigade combat teams are composed of several divisional units including one maneuver brigade and several supporting units. Not all types of premodular brigades are included in the table.
- c. Based on the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- d. Includes 110 unmanned ground vehicles weighing roughly 3.5 tons each.

Unattended Sensors, Launchers, and the Network. The remaining hardware systems in the FCS program are the unattended ground sensors and a missile launcher (see Figure 1-7).

- The unattended ground sensors are small modules equipped with low-cost, expendable, multimodal sensors that are designed to detect intruders, chemicals, and biological agents and provide surveillance in remote locations.

- The non-line-of-sight launch system (NLOS-LS)—a launch container equipped with 15 advanced missiles—can be easily transported and can be operated remotely or set for autonomous operations.

The final component of the FCS program is the network, which “enables the FCS ... to operate as a cohesive system of systems where the whole of its capabilities is greater than the sum of the parts.”²⁴ The network encompasses the common operating software that allows FCS components to communicate with each other and share data; the communications and computer systems that provide secure, reliable access to information over extended distances and complex terrain; and intelligence and surveillance sensors that allow weapon systems in the FCS-equipped BCT to avoid enemy fire, maintain contact with each other, and destroy adversaries at long range.

Fielding FCS Components in Brigade Combat Teams

Based on the Army's plans in early 2009, the 14 FCS components and associated network would have been used to equip a fourth type of modular BCT known as the FCS brigade combat team (FBCT). Those BCTs would have included 322 FCS-manned vehicles rather than the roughly equivalent number of armored vehicles in HBCTs and SBCTs (see Table 1-4). In addition, each FBCT would have been equipped with more than 100 MULEs (including all three versions), 81 SUGVs, 24 NLOS-LS systems, 359 unattended ground sensors, and 122 UAVs (including both classes). An FBCT would have had roughly the same number of armored vehicles as an HBCT or SBCT but fewer trucks (590). The design as of late 2008 also had fewer soldiers assigned to an FBCT—3,300—than any of the three standard modular BCTs had. The Army argued that those reductions would have been possible because the more reliable and fuel efficient FCS vehicles would have required fewer personnel to maintain and resupply them. Nevertheless, even with fewer overall vehicles, the estimated weight of all the equipment associated with an FBCT is 21,800 tons, slightly less than that of an HBCT but much more than that of an SBCT.

24. U.S. Army FCS Brigade Combat Team Program Manager, *Future Combat Systems (Brigade Combat Team): 14+1+1 Systems Overview* (March 14, 2007), p. 5.

Table 1-5.
Systems in the FCS Spin-Out Program

	Early Spin-Out	Threshold Spin-Out ^a
Included Systems	Unattended ground sensors	Class I UAV ^b
	Non-line-of-sight launch system	Class IV UAV
	Class I UAV Block 0	Small UGV ^b
	Small UGV Block 1	Armed robotic vehicle-assault-light
		Countermines
		MULE UGV
Year of Scheduled Events		
Undergo user testing	2008	2012
Enter production	2010	2013
Field to first unit	2011	2014

Source: Congressional Budget Office based on data from the Department of the Army.

Note: FCS = Future Combat Systems; UAV = unmanned aerial vehicle; UGV = unmanned ground vehicle; MULE = multifunctional utility/logistics and equipment.

a. The Threshold Spin-Out will include fielding of the unattended ground sensors and non-line-of-sight launch system included in the Early Spin-Out.

b. The production version Class I UAV and small UGV included in the Threshold Spin-Out will also replace the preproduction versions fielded in the Early Spin-Out.

The FCS Spin-Out Program

The Army intends to introduce some components developed in the FCS program into modular brigade combat teams that are and will continue to be equipped primarily with current technologies. Although the components will be developed and tested under the auspices of the FCS program, they will be purchased and fielded with funding provided in the separate FCS Spin-Out program. Under that program as structured in late 2008, all FCS components except for the manned vehicles and the MULE transport vehicle will be purchased and distributed to the Army's IBCTs in brigade sets as they become available.²⁵ In addition, components of the FCS network will be integrated into some of the existing high mobility multipurpose wheeled vehicles (HMMWVs) so that information can be shared throughout the IBCT.

Schedule. Based on the plan as of late 2008, the fielding of the various FCS components will take place in two stages and follow the testing and demonstration of those systems in the FCS program. Specifically, four FCS components—unattended ground sensors, the non-line-of-sight launch system, and early versions of the Class I UAV and the SUGV—will begin to enter IBCTs in 2011. Two of those systems (the UGS and NLOS-LS) began testing and evaluation with the Army's evaluation task force in 2008 and are scheduled to enter production in 2010.²⁶ Early versions of the other two systems (the UAV and SUGV) have been used in Iraq and Afghanistan. Although not as capable as the versions that will be included in the FCS program because they do not carry the same sensors as FCS components will, their performance in operations overseas showed such promise that the Army's Chief of Staff was eager to get them into the field. The fielding of those four systems, along with kits that will be installed in HMMWVs to tie them to a rudimentary version of the FCS network, is referred to as IBCT Early (see Table 1-5).

The second stage of the Spin-Out, IBCT Threshold, will include the Class IV UAV and two unmanned ground vehicles—the MULE countermines vehicle and the armed robotic vehicle-assault-light, as well as the full production versions of the Class I UAV and SUGV. As currently scheduled, the Army will begin fielding systems included in the Threshold Spin-Out to its IBCTs in 2014.

Spin-Out Systems in BCTs. The quantities of each type of FCS component fielded per infantry brigade combat team as part of the Spin-Out program are smaller than the number that the Army planned to field in an FBCT (see Table 1-6). Based on planning factors as of late 2008, the Army expects that only 81 of the IBCT's HMMWVs will be equipped with kits that would allow them to be

25. Secretary of Defense Gates announced in April 2009 that FCS components would be fielded to all of the Army's BCTs in an expanded Spin-Out program. As this study went to press, however, details of the schedule for fielding FCS components for brigades other than IBCTs were not available. Therefore, CBO's analysis and all discussions in this paper are based on the Army's plans for its Spin-Out program as of late 2008.

26. The Army's evaluation task force is a unit of roughly 1,000 soldiers based at Fort Bliss, Texas, that tests and evaluates prototypes of FCS components in the field.

Table 1-6.
Quantities of FCS Components Planned for Modular Brigade Combat Teams

Systems	Type of Brigade Combat Team	
	FCS ^a	Infantry
Early and Threshold Spin-Out		
Unattended ground sensors	359	41
Non-line-of-sight launch system	24	6
Class I unmanned aerial vehicle	90	22 ^b
Small UGV	81	38 ^b
Threshold Spin-Out Only		
Class IV unmanned aerial vehicle	32	16
Armed robotic vehicle-assault-light	45	29
Countermine multifunctional utility/logistics and equipment UGV	30	2

Source: Congressional Budget Office based on data from the Department of the Army.

Note: FCS = Future Combat Systems; UGV = unmanned ground vehicle.

- a. Based on the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- b. Preproduction versions will be fielded in the Early Spin-Out. Similar numbers of production versions will be fielded in the Threshold Spin-Out.

part of the network in the Early IBCT Spin-Out configuration. That is in contrast to the more than 300 combat vehicles in a fully equipped FCS brigade that would have been tied into the network. The Threshold IBCT Spin-

Out includes kits to fully integrate 84 HMMWVs into the network, as well as less capable network connections for an additional 412 HMMWVs and medium trucks in the IBCT (out of a total of approximately 1,000 trucks).

In addition, relative to what was planned for FCS brigades, IBCTs will have roughly two-thirds as many armed robotic vehicles, less than half as many SUGVs, and less than 12 percent as many unattended ground sensors. Finally, infantry BCTs will be equipped with less than one-third as many UAVs and one-quarter the number of non-line-of-sight launch systems found in FCS brigades.

Costs. The costs to equip all of the Army's IBCTs with FCS components, albeit at lesser quantities than are scheduled for fully equipped FCS brigades, could be substantial. Funds to purchase FCS components and to develop and purchase integration kits for existing vehicles are included in the Spin-Out program, which is separate from the original FCS program. Development funds from 2009 through 2013 total \$246 million, according to documents submitted with the Bush Administration's 2009 budget, although more funds could be needed as a result of revisions to the program. Funds to procure all equipment necessary to introduce and integrate FCS technologies into the 43 IBCTs could total \$18 billion.²⁷

27. Scott Davis and Steve Marion, the Boeing Company, "FCS Program Overview: Advanced Planning Briefing for Industry (APBI)," October 2008, http://contracting.tacom.army.mil/future_buys/FY08/APBI%202008%20-%20Day%202/davis.pdf.

Are the Army's Transformation Initiatives Meeting Their Goals?

The Army introduced its Future Combat Systems program and Modularity Initiative to further its attempts to transform the service from one designed primarily to fight one large enemy (as in the Cold War) to one more suited to deal with the varied conflicts and missions that are likely to occur in the 21st century. The programs were designed to substantially reorganize and reequip the Army and to do so relatively quickly. When General Eric Shinseki introduced the FCS program in 2000, he envisioned an Army that differed completely from the one he had inherited as the Chief of Staff. In particular, he wanted to create an Army that included brigade combat teams with these characteristics:

- They were equipped uniformly,
- They could deploy anywhere in the world in 96 hours or less,
- They included armored combat vehicles that weighed less than 20 tons each, and
- They were equipped with the new systems starting in 2008.

General Peter Schoomaker's Modularity Initiative, which was introduced four years later, also had ambitious goals for transforming the Army. The Modularity Initiative, when first introduced, aimed to do the following:

- Create combat units that would be interchangeable;
- Create more combat units in the Army without increasing the number of military personnel;
- Complete the conversion of the combat units in the active Army by 2006; and

- Finish the conversion, including purchases of needed equipment, for \$21 billion.

This chapter will examine those two programs to see if they are meeting the goals laid out for them when they began.

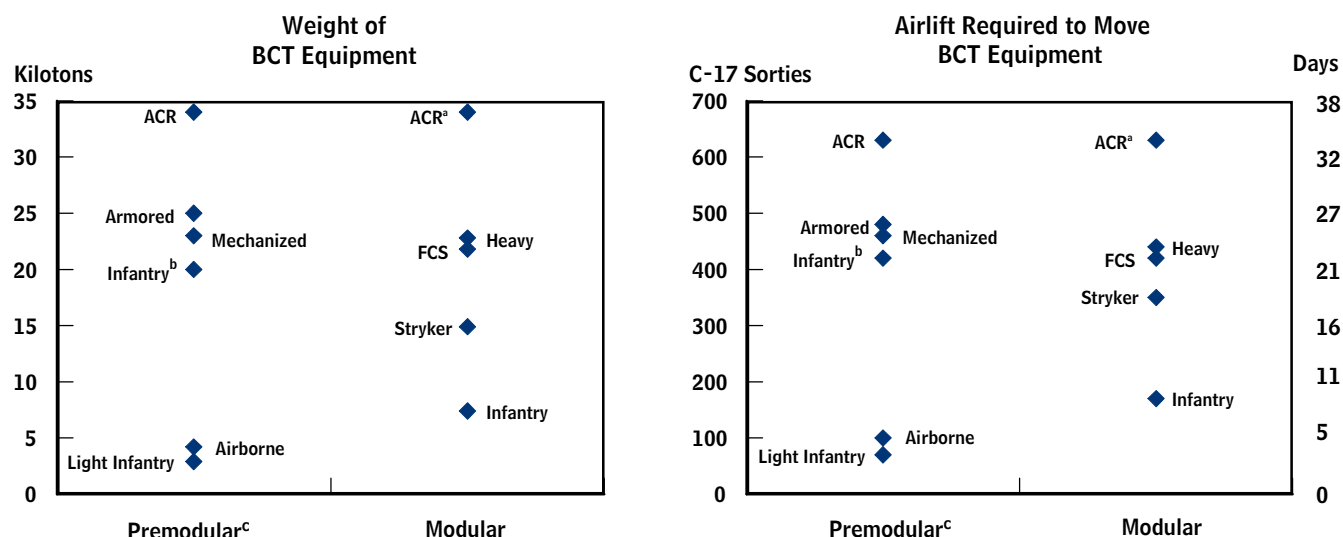
How Are the Army's Transformation Initiatives Affecting Its Combat Units?

In this analysis, the Congressional Budget Office examined how the Army's two premier transformation programs are affecting its combat units to see if they are yielding the promised benefits. Specifically, CBO sought to answer several questions.

- Are the reorganized and reequipped BCTs easier to deploy than the ones they replaced?
- Are combat units uniformly equipped, and will they be in the future?
- Are the programs on schedule?
- And was the Army able to create additional BCTs without adding personnel?

The analysis answers those questions by examining the status of and plans for the Modularity Initiative and FCS program as of the end of 2008.¹

1. Plans at the end of 2008 included 76 BCTs for the modular Army, 48 of which would be in the active component; the development and procurement of eight types of manned vehicles in the FCS program; and the ultimate procurement and fielding of 15 BCTs equipped with all 14 components developed in the FCS program.

Figure 2-1.**Comparison of Deployability of Premodular and Modular Brigade Combat Teams**

Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; ACR = armored cavalry regiment; FCS = Future Combat Systems.

- a. One armored cavalry regiment is being retained in the active Army's modular structure.
- b. Premodular infantry brigades, which included one tank and one mechanized battalion, were found primarily in the Army National Guard.
- c. A premodular brigade combat team contained one maneuver brigade and additional support units.

Are Modular BCTs Easier to Deploy than Premodular Units?

One goal of the Army's transformation initiatives was to create combat units that would be easier to deploy overseas than the ones they replaced. To do that, the Army needed to design units with lighter equipment, which could be transported more easily by cargo airplane (or ship).

When the Army's planned modular reorganization is complete in 2013, the total weight of equipment associated with the BCTs will, in fact, be less than it was in 2003 (see Figure 1-3 on page 7). That reduction, however, results more from a change in the type of combat units in the Army—fewer heavy brigades and more infantry brigades—than from a decrease in the weight of the equipment associated with individual brigades. In fact, modular infantry brigade combat teams, which will make up more than half of the Army's combat structure for the foreseeable future, are heavier than the premodular BCTs they replace (see Table 1-4 on page 15). And modular heavy BCTs are only slightly lighter than their premodular counterparts. In contrast, Stryker BCTs are lighter

than the only premodular medium-weight infantry combat brigades, which included one tank battalion and one mechanized infantry battalion and were found primarily in the National Guard. Finally, the Future Combat Systems BCTs, which were scheduled to enter the force in 2016, would have been slightly—4 percent—lighter than the HBCTs they were scheduled to replace. Furthermore, the weight of an FBCT, which had been increasing over the past few years, may have eventually equaled or exceeded that of a modular HBCT.

Although some of the transformed BCTs will be lighter than their predecessors, they will not necessarily be able to deploy overseas much more quickly, because many planeloads of large Air Force cargo aircraft are required to transport even the lightest units. A modular IBCT would fill 170 C-17s with its equipment, for example, and the equipment associated with an HBCT requires more than 400 C-17 loads to transport (see Figure 2-1). Although the Air Force plans to have 205 C-17s in its fleet, the number of aircraft that can arrive at an airport and unload their cargo in one day is limited by the amount of tarmac space. For airports typical of the places that the

United States might need to send a brigade quickly, the number of daily C-17 sorties would be limited to slightly less than 20. As a result, it could take 10 days to transport even the lightest modular BCT overseas. Larger and heavier units—such as HBCTs or even FBCTs—could take up to 24 days to deploy, assuming that sufficient numbers of C-17s were available to move them.

Neither the Modularity Initiative nor the FCS program will yield an Army that is able to move its equipment overseas more easily. The modular IBCT is much heavier—and would take perhaps six days more to deploy—than the Army's premodular light IBCT. As a result, even the lightest modular brigades will not be able to deploy to remote locations in 96 hours. Thus, the transformation initiative has not made—and most likely will not make—the Army's brigades easier to transport overseas in any meaningful way.

Even though modular BCTs are not easier to transport overseas than their premodular predecessors, however, they need less time to prepare to deploy because they are more suitably structured and capable of operating more independently, according to the Army. Premodular maneuver brigades, when deployed, were supplemented with support units from a division to form BCTs that included roughly the same number of personnel and types of units as do modular BCTs (see Figure 2-2). But the Army found the formation of such premodular BCTs from disparate units within divisions both time-consuming and disruptive. Modular BCTs are composed of combat and support units that are accustomed to working with each other and are, therefore, ready to deploy overseas on relatively short notice. In addition, when modular BCTs need to replace similarly configured units to support long-standing overseas operations, the transition will be seamless, the Army contends.

The Army further argues that because each modular BCT includes some units needed to support its operations—such as signal units and engineer units—it can operate independently without the significant support that was previously found only at the division level. If necessary, the United States could dispatch a modular brigade of roughly 4,000 or fewer personnel in response to a crisis without the need to send an entire division of 15,000 soldiers, thus enabling a more rapid response. In the premodular structure, the Army contends, a maneuver brigade would not have been able to operate safely or effectively on its own. Furthermore, by making BCTs

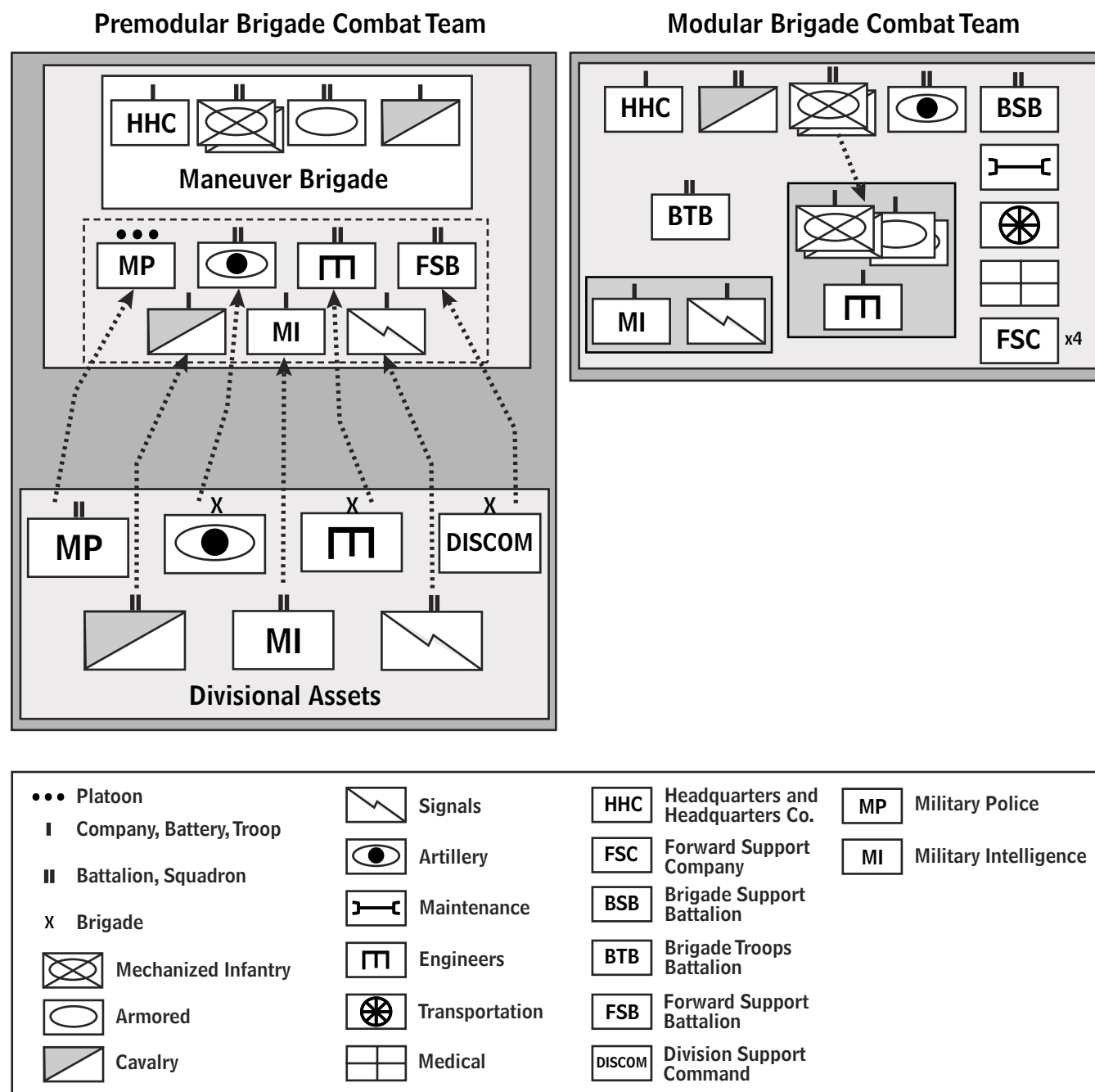
more independent of their divisions, field commanders will be able to tailor forces to meet their needs. In that way, commanders could amass a force, including any number of division headquarters and BCTs, if appropriate, rather than be constrained to the three maneuver brigades per division that was standard in the premodular Army.

Since converting to the modular structure, however, the Army has typically deployed BCTs overseas with at least one division headquarters, and the assignment of individual BCTs to higher headquarters has not differed greatly from previous practices. During operations in Afghanistan, for instance, the Army has typically deployed three BCTs with one division headquarters. In Iraq and Kuwait, the ratio has usually been three to seven BCTs per division or corps headquarters. The difference in practice between operations in the two countries may be the presence of many more supporting units and higher command structures in Iraq and nearby Kuwait than in Afghanistan, which reduces the amount of higher-level command and support needed for each BCT. Nevertheless, a division headquarters assigned to Iraq would generally be accompanied by at least two of its associated BCTs, its aviation brigade, and some of its remaining units. It could also be assigned one to three BCTs from other divisions. Combining units in that way does indicate that modular BCTs may be more interchangeable and flexible than premodular maneuver brigades were.

Are Modular BCTs Standardized?

One motivation for both the Modularity Initiative and the FCS program was to create more combat units that would be interchangeable—that is, uniformly equipped and structured. General Shinseki envisioned that the FCS program would transform the Army into a force in which all brigade combat teams would be identically organized and equipped with futuristic combat vehicles and associated equipment. Although that goal was abandoned relatively quickly, the Army still strives for a standardized structure and set of equipment for its combat units. The Modularity Initiative relaxed those constraints somewhat, allowing for three types of BCTs in the Army. But how uniform will those units be after they have been converted to modular configurations?

Proliferation of Types of Modular Units. According to the Army's schedule, all of its combat brigades will have been converted to the modular design by 2013. That conversion should mean that any particular BCT could

Figure 2-2.**Comparison of Structure of Premodular and Modular Brigade Combat Teams**

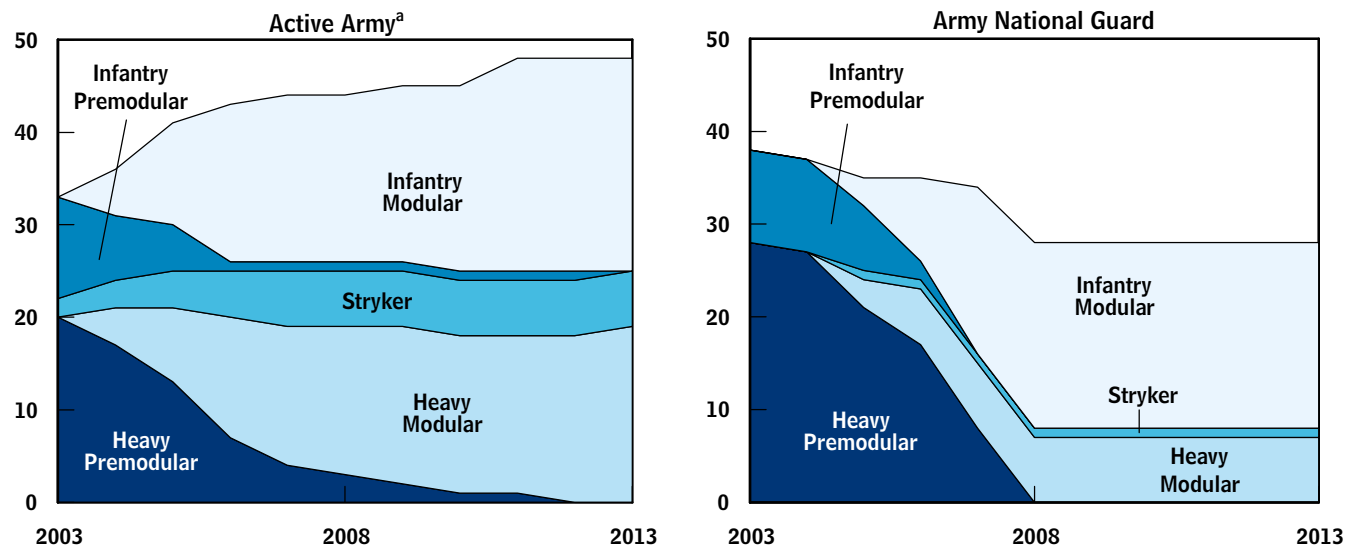
Source: Department of the Army, *Army Transformation, Report to the Congress of the United States* (February 2007).

Note: According to the Army, the advantages of the modular brigade combat team are that it is a self-contained organization with organic support capabilities; it offers a significant increase in intelligence and reconnaissance capabilities; and it can operate interchangeably with different corps and division headquarters.

Figure 2-3.

Planned Disposition of the Army's Brigade Combat Teams Through 2013 Under the Previous Administration's 2009 Plan

(Number of BCTs)



Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; infantry BCTs include no tanks.

a. Defense Secretary Robert M. Gates announced in April 2009 that the active Army would grow to a total of 45 BCTs by 2013 rather than the 48 BCTs included in the previous Administration's 2009 plan.

be described by one of three designs—heavy, infantry, or Stryker (see Figure 2-3). Even though the Army has not yet finished converting all of its combat units to modular formations, however, it has decided to retain two variants each of the heavy BCTs and infantry BCTs. In addition to the standard heavy and infantry BCTs, the Army now fields one armored cavalry regiment (ACR), which is a slightly larger version of an HBCT, and an airborne version of the IBCT.² Although the variations may not be extensive, they indicate that the Army is willing to stray from its stricture that all modular units of a given type must be identical so that they can be easily interchangeable. That emergence of different types of heavy and infantry BCTs is one way that modular units can become less standardized.

2. The main differences between the Army's only armored cavalry regiment and the remainder of the heavy brigades are that it has twice as many tanks, 30 additional Bradley fighting vehicles, and 700 more personnel. The differences between the airborne and regular IBCTs are much smaller, with the former having 100 more personnel and roughly 20 more trucks, some of which are specially designed to be dropped from airplanes.

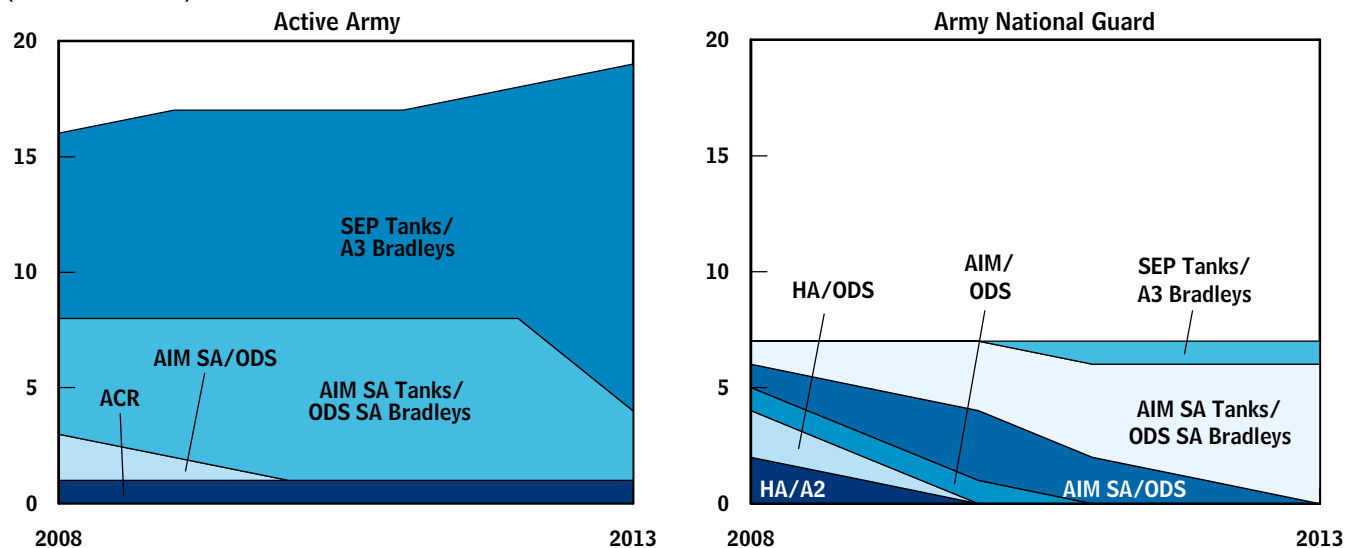
Variation in the Equipment of Modular Units. A second way that modular units can become less standardized is through variations in the equipment that combat units of the same design are assigned. That distinction can best be illustrated by closely examining the Army's plans for its heavy combat units.

At the end of 2008, the Army planned to have 26 HBCTs in its forces in 2013. Nineteen of those units (including the one armored cavalry regiment that the Army has decided to retain) would be in the active Army, and seven would be in the National Guard. Except for the ACR, all of the Army's heavy combat brigades would have the same number of personnel, tanks, Bradley fighting vehicles (BFVs), trucks, and other types of equipment. Because the Army does not have sufficient numbers of the same types of tanks, BFVs, and trucks to equip all of its HBCTs in exactly the same way, however, it has decided to create two subclasses of HBCTs, each with a particular variant of tank, fighting vehicle, and other associated equipment. The goal of that approach is to equip nine HBCTs with the less modern versions of the Abrams tank and Bradley fighting vehicle, known as the

Figure 2-4.

Planned Equipping of Modular Heavy Brigade Combat Teams Through 2013 Under the Previous Administration's 2009 Plan

(Number of BCTs)



Source: Congressional Budget Office based on data from the Department of the Army.

Notes: The armored cavalry regiment (ACR) has a unique structure with more tanks and Bradley fighting vehicles than standard heavy brigade combat teams.

The models of Abrams tank, in order of increasing sophistication, are HA, AIM, AIM SA, SEP. The models of Bradley fighting vehicle, in order of increasing sophistication, are A2, ODS, ODS SA, A3.

BCT = brigade combat team; SEP = Systems Enhancement Program; AIM = Abrams Integrated Management; SA = situational awareness (refers to vehicles equipped with a second-generation forward-looking infrared viewer); ODS = Operation Desert Storm; HA = heavy armor.

M1A1 Abrams Integrated Management (AIM) and A2 Operation Desert Storm (ODS), respectively, and the remainder with the newer M1A2 Systems Enhancement Program (SEP) tank and the A3 version of the Bradley fighting vehicle. The majority of BCTs with older vehicles will be in the Guard (see Figure 2-4). In sum, according to current plans, there will be at least three variants of HBCTs in the Army in 2013: one ACR, HBCTs with M1A2 SEP tanks, and HBCTs with M1A1 AIM tanks.

Any future improvements that the Army plans to make to its armored combat vehicles will further boost the number of different configurations of heavy combat brigades. That is because the Army's 26 HBCTs include a total of roughly 1,500 tanks and 3,200 Bradley fighting vehicles. The most modern versions of the tanks and BFVs were introduced in the late 1990s, but it will be 2013 before all of the HBCTs are equipped with one of the two latest versions of those weapons, at which point the designs will

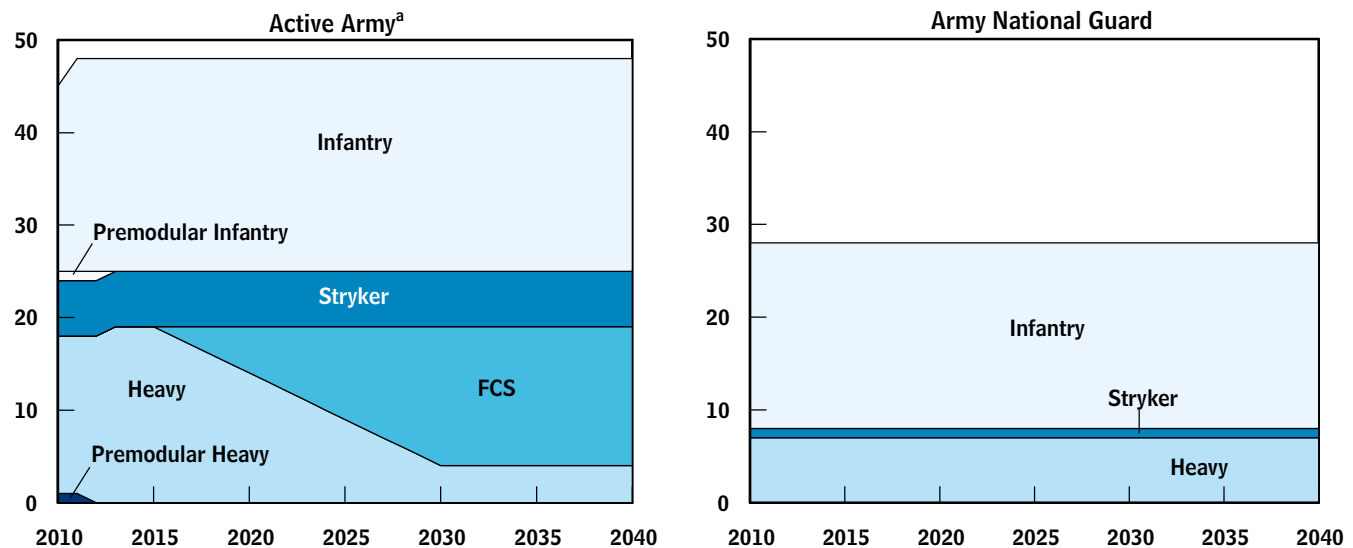
be almost 15 years old. Until then, some units will be equipped with even older and less capable models.

After 2013, the Army will most likely continue to upgrade its armored combat vehicle fleet by introducing newer and more capable models. Because the Army plans to retain its Abrams tanks and BFVs until at least 2040, programs to upgrade them from the current most modern versions will probably begin in the next decade. Since the mid-1990s, the Army has produced very few brand new Abrams tanks or Bradley fighting vehicles. Instead, it has taken existing vehicles and upgraded them by replacing engines, transmissions, electronics, and armor with improved versions. Any new models that the Army introduces will most likely be produced in the same way. Nevertheless, those upgrades are expensive—costing up to \$12 million per vehicle. Because of budget constraints, since 1990 the Army has typically upgraded less than

Figure 2-5.

Planned Disposition of the Army's Brigade Combat Teams Through 2040 Under the Previous Administration's 2009 Plan

(Number of BCTs)



Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; FCS = Future Combat Systems.

- a. Defense Secretary Robert M. Gates announced in April 2009 that the active Army would grow to a total of 45 BCTs by 2013 rather than the 48 included in the previous Administration's 2009 plan. At the same time, he also announced the cancellation of the manned vehicle portion of the FCS program, thereby also canceling the fielding of FCS BCTs.

10 percent of each of its armored fleets per year.³ At that pace, it would take more than 10 years to modernize all of the armored vehicles in the Army's HBCTs. Because the Army is constantly improving and upgrading its weapons, it will always have BCTs of the same type—HBCTs, for example—that are equipped differently.

The Effect of the FCS Program and Its Spin-Outs on the Army's Modular Units

Under the previous Administration's 2009 plan, the Army expected to start equipping heavy combat brigades with the full suite of FCS components in 2016. That process would have taken until 2030 to complete because the Army expected to purchase FCS equipment—including eight types of manned ground vehicles—at a rate of one brigade's worth per year starting in 2015 (see Figure 2-5). In 2030, once all of those upgraded units had been fielded, the Army's brigade combat teams would have

comprised 15 Future Combat Systems brigades, 11 heavy brigades, 7 Stryker brigades, and 43 infantry brigades.⁴

Although the Army's plan at the end of 2008 would have limited the full benefit of the FCS program to less than 20 percent of its combat brigades, it also included provisions to introduce some of the systems developed as part of the FCS program into all of its infantry brigades through the FCS Spin-Out program.⁵ The goal of the program is to purchase whichever FCS technologies are available starting in 2010 and to field them to IBCTs

3. Exceptions to that trend occurred in 2007 and 2008, when the Army received funding sufficient to upgrade 14 percent and 12 percent, respectively, of its Bradley fighting vehicles.

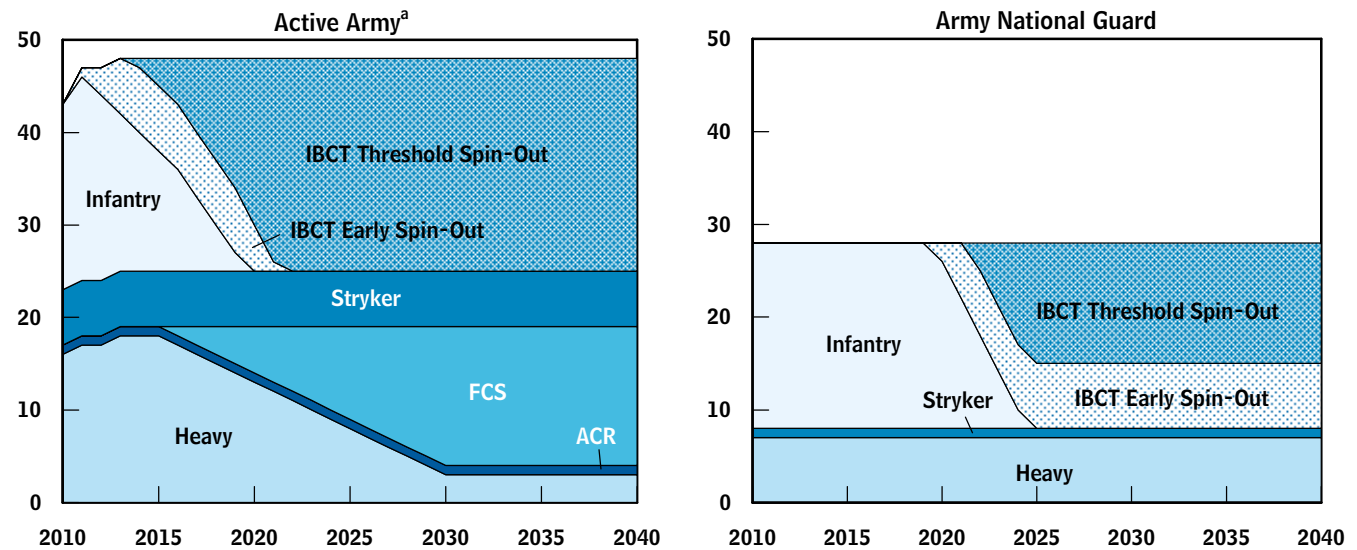
4. Secretary of Defense Robert M. Gates announced in April 2009 that the Army will include 73 BCTs rather than the 76 BCTs included in the previous Administration's 2009 plan.

5. The Army restructured its FCS Spin-Out program in the summer of 2008 from one that would have equipped all of its BCTs, starting with heavy and Stryker BCTs, with components of the FCS program to one that would first equip all of its IBCTs with those components. Subsequent to changes that Secretary Gates announced in April 2009, the Army may plan to introduce FCS components into its heavy and Stryker brigades. However, details of such a plan were not available when this study went to press.

Figure 2-6.

Planned Introduction of FCS Technology into the Army's Modular Brigade Combat Teams Under the Previous Administration's 2009 Plan

(Number of BCTs)



Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; FCS = Future Combat Systems; ACR = armored cavalry regiment; IBCT = infantry brigade combat team.

- a. Defense Secretary Robert M. Gates announced in April 2009 that the active Army would grow to a total of 45 BCTs by 2013 rather than the 48 included in the previous Administration's 2009 plan. At the same time, he also announced the cancellation of the manned vehicle portion of the FCS program, thereby also canceling the fielding of FCS BCTs.

starting in 2011. If the Army carries out the fielding according to its plans as of the end of 2008, by 2025 all of the Army's IBCTs will be equipped with FCS components, except for the manned vehicles and the transport version of the multifunctional utility/logistics and equipment unmanned ground vehicle (see Figure 2-6). Based on its plans at the end of 2008, however, the Army could have as many as three types of IBCTs in the field between 2015 and 2030, each equipped with different amounts of FCS equipment. If the armored cavalry regiment and airborne infantry brigade variants are taken into account, as many as eight variants of BCTs could be in the field at once.

The Army's ambitious modernization plans may make it nearly impossible to achieve one of the primary goals of transformation—uniformity. By introducing various configurations of FCS components and technologies into IBCTs as they become available, the Army may have complicated an already formidable task. At any given time, very few of the Army's units will be equipped and

trained to the same standards, as new equipment is introduced every few years. Furthermore, if history is a guide, the Army may be unable to carry out its program to its completion and will, therefore, end up with a mix of combat units that are differently equipped and organized.

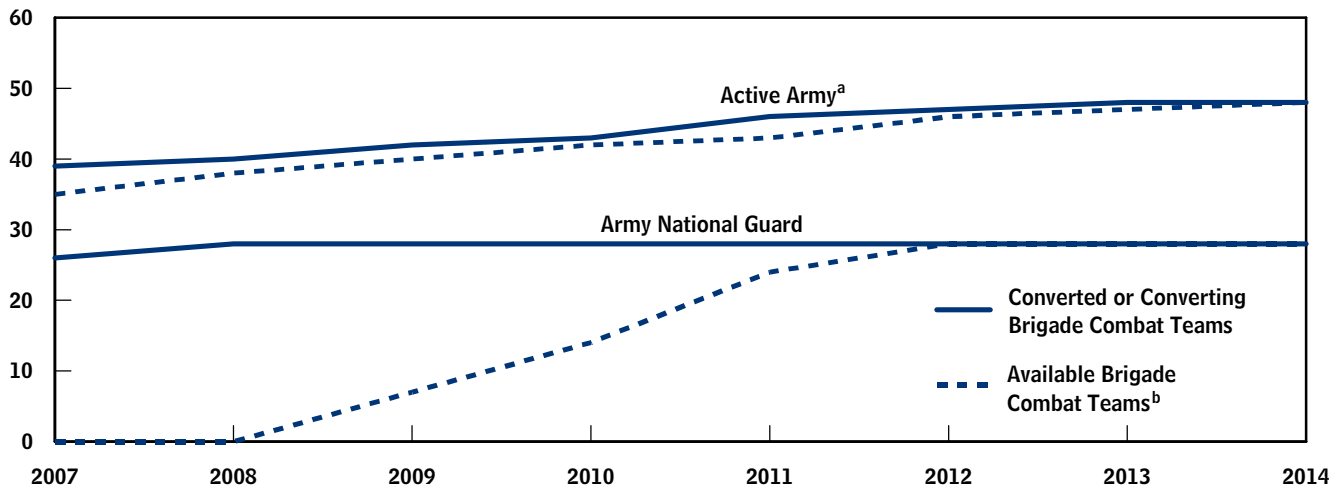
Conversion and Availability of Modular Units and FCS Components

The schedules for the Modularity Initiative and the FCS program have been amended several times since the programs were initiated (see Chapter 1). But schedules that lay out when the conversion of brigades or fielding of FCS components will begin and end do not fully convey the timing of the availability of either modular units or particular FCS technologies. Modular BCTs, although converted on schedule, may not be available for combat missions until some later time. And less capable versions of some FCS components may be introduced into units before components that meet the final standards are developed and produced.

Figure 2-7.

Availability of Converted Brigade Combat Teams Under the Previous Administration's 2009 Plan

(Number of BCTs)



Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team.

- a. Defense Secretary Robert M. Gates announced in April 2009 that the active Army would grow to a total of 45 BCTs by 2013 rather than the 48 BCTs included in the previous Administration's 2009 plan.
- b. Brigade combat teams that have completed conversion and are available for deployment. Some brigades may not receive all of their equipment until 2015.

Availability of Modular BCTs. The Army reports that by 2013, it will have converted all of its brigade combat teams to the modular configuration. As of the end of 2008, all 28 of the National Guard's combat brigades had been converted. The fact that a brigade has been converted, however, does not mean that it has all of the equipment and personnel it needs for the new configuration. Rather, it means that the new modular template for the structure of that BCT—known as the Table of Organization and Equipment (TOE)—has been applied.

Until converted units receive a sufficient portion of their required equipment and personnel, they are not considered available for assignment to missions or to deploy overseas. For active Army units, it may take only a year or two for a converted BCT to receive the appropriate equipment and personnel associated with the modular TOE. But for units in the National Guard, that period may be several years. Because of that lag, by the end of 2008, 38 of the 40 modular BCTs in the active Army were available for deployment. In contrast, none of the 28 modular BCTs in the National Guard was available (see Figure 2-7). According to the Army's plan at the end

of 2008, all 48 of the BCTs planned for the active Army would be converted and available by the end of 2014; some of the Guard's modular BCTs, although officially converted in 2008, would not be available to deploy until 2012. Finally, the Army notes that although all but one of its combat brigades would be converted to the modular formation and available to deploy by 2013, some BCTs might not receive all of their equipment until 2015.⁶

Fielding of Some Prototype FCS Components. At the end of 2008, the Army planned to field early prototypes of three FCS technologies. Systems based on two of those technologies—an early version of the Class I unmanned aerial vehicle and the Packbot, which is very similar to the small unmanned ground vehicle—have been used in Iraq and Afghanistan and are scheduled to be fielded to the

6. That does not mean that the BCTs would deploy to perform missions without all of their needed equipment. Rather, the equipment they were missing would be deemed not essential to the completion of their task, or they would be assigned another less capable piece of equipment as a substitute (an older version of a truck instead of a new and preferred version, for example).

Army's IBCTs as part of the Early Spin-Out program. The previous Administration's 2009 plan included the testing and fielding of the third technology—the non-line-of-sight cannon (NLOS-C) manned vehicle—in 2010 in response to a requirement in the Department of Defense Appropriations Act for 2008. To fulfill that legislative requirement, the Army planned to purchase early versions of the cannon, six per year, in 2009, 2010, and 2011. In that way, 6 cannons could have been fielded by 2010 and a full combat brigade's complement of 18 cannons could have been fielded by 2012. The prototype cannons would not have been as capable as the final version, which was scheduled to start to be fielded with the rest of the manned ground vehicles in 2015. Secretary Gates's announcement of the cancellation of all eight manned vehicles included in the FCS program makes that fielding schedule uncertain, if not unlikely.

Will the Army Have Enough Personnel to Fill and Support the Previous Administration's Proposed Modular Structure?

The Army initially planned to reorganize its forces into modular units without adding military personnel. As the reorganization progressed, however, it became apparent that this would not be possible. An Army assessment in 2006 concluded that the number of active-duty personnel assigned to areas outside of combat and support units would need to be drastically reduced in order to fill the planned modular units in the active Army without increasing costs. To appreciate what the effects of the planned reductions might be, it is necessary to understand how the Army as a whole is organized.

The Army is composed of deployable combat and support units—known as the operating force—and a generally nondeployable portion known as the institutional force or, more recently, the generating force. The operating force includes combat units (such as BCTs) and support units (such as transportation units, military police, and medical units). Units in the operating force can be sent overseas to accomplish missions assigned by national command authorities. Personnel assigned to the institutional or generating force perform tasks necessary to man, equip, and train the Army. Examples of such personnel include recruiters, people who manage programs to buy weapons, and drill sergeants. A final group of soldiers is not assigned to units in either the operating or generating force. That group includes soldiers in basic training who have not yet been assigned to a unit, soldiers moving between assignments, soldiers in jail or a hospital, and

soldiers attending school as part of their career advancement. That group of soldiers, referred to as transients, trainees, holdees, and students (TTHS)—or the Individuals Account—has represented a relatively stable and sizable portion of the active Army (12 percent, on average) for the past 20 years.

Before the Army introduced its Grow the Army initiative in January 2007, it had planned to substantially cut its generating force and Individuals Account to free up soldiers to fill its modular units. In 2006, the Army planned to create 42 BCTs and associated support units in its active component. To fill those brigades, the service estimated that it would need 355,000 personnel in its operating force, an increase of 46,000 from 2003. After a temporary increase, the total size of the active Army was to remain relatively unchanged, however, increasing by only 2,400 soldiers from its authorized end strength of 480,000 in 2003.⁷ To provide a sufficient number of soldiers for the operating force, therefore, the Army planned to reduce the size of its generating force by 31 percent, from 108,000 soldiers in 2003 to 75,000 in 2008. The size of the Individuals Account would also be decreased, but by a lesser amount—16 percent—from 63,000 soldiers to 52,000. The 44,000 soldiers freed up by those reductions, plus the small increase in end strength, would then be available to populate the active Army's operating force.

Assessments of the planned changes, including some by the Army, questioned the feasibility of making such large reductions in the generating force and the Individuals Account. The number of personnel that had supported the premodular force might not have been enough to support even the smaller modular force envisioned in 2006. That consideration may have prompted in part the Army's decision in early 2007 to increase the size of its active-duty force to 547,400 soldiers.

Even the increases in end strength included in the GTA initiative may not be sufficient to fully support the modular force included in the previous Administration's plan, however. In 2013, when the reorganization was scheduled to be completed, the Army would have needed a total of 871,000 soldiers in its active, National Guard, and Reserve components to fill its planned 76 combat units and roughly 220 support units—an increase of 112,000

7. End strength is the number of personnel authorized to be in the Army at the end of the fiscal year.

Table 2-1.

Changes in the Distribution of the Army's Personnel Under the Previous Administration's 2009 Plan

(Thousands)	2003	2007	2013
Active Army			
Force Structure			
Operating force	309	351	404
Generating force	108	93	80
Subtotal	417	444	484
Individuals Account	63	74	63
Subtotal	480	518	547
Army National Guard			
Force Structure			
Operating force	314	308	321
Generating force	36	35	35
Subtotal	350	343	356
Individuals Account	0	8	2
Subtotal	350	351	358
Army Reserve			
Force Structure			
Operating force	136	126	146
Generating force	69	59	48
Subtotal	205	185	194
Individuals Account	0	20	12
Subtotal	205	205	206
Total Army			
Force Structure			
Operating force	759	785	871
Generating force	213	187	163
Subtotal	972	972	1,034
Individuals Account	63	112	77
Total	1,035	1,084	1,111

Source: Congressional Budget Office based on data from the Department of the Army.

Note: Entries for 2003 and 2007 reflect distribution of personnel among the different accounts. Entries for 2013 represent planned requirements.

soldiers from the force structure that existed in 2003. The Army is expected to grow by only 76,000 soldiers between 2003 and 2013, however. To find the additional 36,000 personnel it needed to fill its previously planned operating force, therefore, the Army planned to change the way in which it carried out tasks to train, recruit, and equip its operating force and how it managed its personnel.

The rest of this section examines in detail how the Army's planned changes would affect the personnel requirements of its three components.

Personnel Requirements in the Active Army. Based on the previous Administration's 2009 plan, the active Army would have experienced the biggest increase in operating forces from 2003 to 2013, growing by 95,000 billets. That increase is significantly larger than the 67,000 soldiers who will be added to the active Army's total size over the same period.⁸ The Army planned to make up that deficit by reducing the size of the generating force in the active Army by 28,000 personnel (compared with the size in 2003) and by keeping the number of soldiers in the Individuals Account constant (see Table 2-1).⁹

Increasing the size of the operating force at the expense of other portions of the active force structure would alter what had been a stable relationship. Since 1980, soldiers in the operating force have represented 63 percent of the active Army's total personnel, on average; soldiers in the generating force have constituted about 25 percent; and soldiers not assigned to units have accounted for roughly 12 percent. The Army planned to expand to 74 percent the share of personnel assigned to the operating force and reduce to 15 percent the share assigned to the generating force. Based on the Army's plans at the end of 2008, the share of personnel in the Individuals Account would have diminished to 11.5 percent.

The Army believes that it can reduce the size of the generating force by allowing civilians to assume some of the duties now performed by soldiers. Although the Army

8. If the active Army includes 45 BCTs rather than the previously planned 48 BCTs, then the likely reduction of three IBCTs, relative to the previous Administration's 2009 plan, would lessen the total number of soldiers needed to fill combat units in the active Army by slightly more than 10,000 soldiers.
9. All numbers relating to personnel have been rounded to the nearest thousand.

could hire civilians or contractors to perform some tasks currently carried out by military personnel, it may not be possible or appropriate for civilians to act as recruiters or drill sergeants or to determine what the performance characteristics of new weapon systems should be. And, although hiring civilians or contractors to perform tasks that are currently performed by soldiers may be a way to increase the number of soldiers available to fill the operating force, it is not necessarily less expensive than increasing the number of military personnel in the active Army.

In addition, the Army's plan to reduce the size of the Individuals Account in the active Army may not be feasible. Although the change from 12 percent to 11.5 percent seems relatively small, it represents a difference of almost 3,000 soldiers. And that historic average of 12 percent may be artificially low because it includes a period when the size of the Army was decreasing. A realistically sized Individuals Account for a period when the Army is growing or of constant size might be closer to 13 percent.¹⁰

Furthermore, the Army had been planning to reduce the absolute size of the Individuals Account from 74,000 in 2007—which represented 14 percent of the active Army's total end strength—to 63,000 in 2013. Although the Army argues that it can reduce the number of transients (or soldiers moving between assignments) by instituting new personnel policies, transients made up only 15 percent of the total Individuals Account in 2001. Enlisted personnel and officers in school, as well as cadets at West Point, account for another 25 percent of the Individuals Account. Unless the Army changes its policies regarding the need for continuing education for career advancement, it is unlikely that the number or percentage of its officers and enlisted personnel in school will decrease. In fact, the absolute number may rise as the total number of personnel in the Army grows. Finally, enlisted trainees, primarily those in basic training, account for more than half of all soldiers not assigned to units. Again, as the size of the active Army increases, so will the number of new recruits entering every year, as well as the number of soldiers in basic training.

10. A shrinking Army needs fewer annual accessions and therefore would have fewer soldiers in basic training at any given time. Conversely, a growing or stable Army would require more accessions and have more soldiers in basic training. See Colonel Charles Kaylor, *Army Individuals Account and Force Manning (Understanding TTHS)*, undated.

In summary, the Army's plan at the end of 2008 to increase the percentage of its active soldiers assigned to the operating force appears to be ambitious and may be, on the basis of history, unachievable. Reducing the number of soldiers not assigned to units may be difficult in light of the increase in the number of annual inductees that will be needed to support a larger Army. And using civilians or contractors to fill very many positions in the generating force that are currently occupied by soldiers may not be feasible.

In recognition of the Army's difficulty in providing sufficient personnel to fill its units, Secretary Gates announced in April 2009 that the active Army will include 45 BCTs rather than the 48 BCTs included in the previous Administration's 2009 plan. Secretary Gates said his decision was motivated by a desire to ensure that the Army's units were more fully manned and ready to deploy and to reduce the risk of a hollow force.

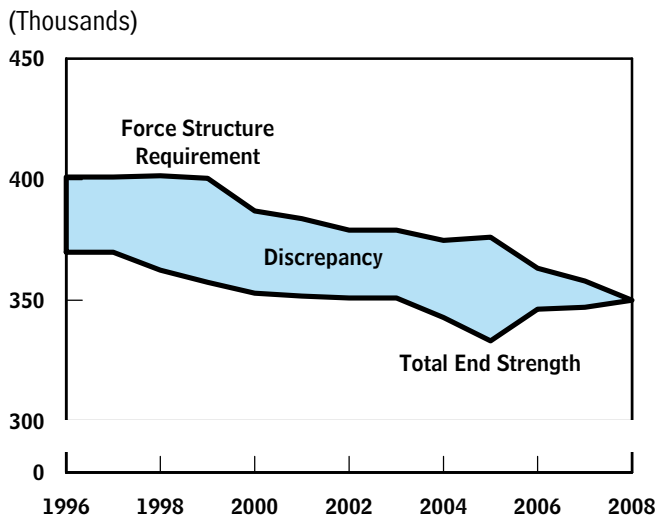
Personnel Requirements in the Army National Guard. In contrast with the active Army, the operating force planned for the National Guard will grow by a much smaller amount, from one that included 314,000 soldiers in 2003 to 321,000 soldiers in 2013.¹¹ Likewise, based on the Army's plans as of the end of 2008, the Guard's generating force will decrease slightly, from 36,000 soldiers to about 35,000. Over that 10-year period, however, the total number of soldiers in the Guard is scheduled to climb from 350,000 to 358,000.

Although the number of personnel assigned to the Guard's operating force is not scheduled to change substantially from 2003 to 2013 under the Army's Modularity Initiative, the change in requirements over the same period is much greater. In 2003 and for many years before that, the Guard's force structure required many more soldiers to fill it than were available. For example, in 1999, the Guard's force structure requirements—that is, personnel needed to fill both the operating and generating forces—exceeded the Guard's total military personnel by more than 40,000 soldiers (see Figure 2-8). The Army decided to address that mismatch between requirements and available resources by reducing the requirements for the Guard's operating force. As a result, by 2007 the

11. Secretary Gates's announcement did not include any specific changes to force structure in the National Guard. Therefore, the Army's plans for personnel distribution in the National Guard may not have changed from those in effect at the end of 2008.

Figure 2-8.

Discrepancy Between the Army National Guard's Force Structure Requirements and Its Available Personnel



Source: Congressional Budget Office based on data from the Department of the Army.

Note: The force structure requirement is the number of personnel needed to fill combat units and support units. End strength is the number of personnel in the Army National Guard at the end of the fiscal year.

Guard required 308,000 soldiers for its operating force, about 28,000 fewer soldiers than it had required in 2003. In addition, the requirements for the Guard's generating force also declined slightly, to 35,000 personnel.

At the same time, the Army proposed creating an Individuals Account in the Guard—which heretofore had not existed—that would provide allowance for 8,000 soldiers who were unavailable to be assigned to units. Without such an allowance, soldiers would nominally be assigned to units but might be unavailable to deploy because they were being trained or were in a school, hospital, or jail. As a result, a unit might, on paper, be at full strength but in reality would be missing a portion of its assigned soldiers. At 8,000 soldiers, the Guard's planned Individuals Account represented a smaller share—about 2 percent—of personnel in the Guard than does the Individuals Account in the active Army.

After the Army announced the Grow the Army initiative in 2007, it reversed, to some extent, the plans and policies for the Guard's structure that it had initiated previously. Compared with its end strength in 2007, the Army now plans to add 7,000 soldiers to the Guard by 2013, but it also plans to increase the requirement for the Guard's operating force by 13,000 soldiers, significantly more than the planned increase in end strength. At the same time, the Army plans to reduce the size of the Guard's Individuals Account to 2,000 soldiers (see Table 2-1 on page 29). (The Army plans to keep the number of soldiers needed to fill the Guard's generating force at 35,000.) The combined effect of those expected changes would be a Guard in 2013 that will need 356,000 soldiers to fill its force structure from a total personnel pool of 358,000 soldiers. That force structure provides a very small margin for those soldiers who cannot be assigned to units for whatever reason, and it may yield a Guard that has difficulty filling its units with personnel.

Personnel Requirements in the Army Reserve. The planned changes in the Army Reserve's force structure in place at the end of 2008 are similar to those for the Guard. In short, the Reserve's total end strength is expected to increase between 2003 and 2013, but not by as much as the size of its operating force. To compensate, the Army plans to increase the Reserve's operating force primarily by reducing the size of its generating force.

The Reserve's force structure in 2003 included 136,000 soldiers in the operating force and 69,000 soldiers in the generating force.¹² But, like the Guard, the Army Reserve did not have an Individuals Account in 2003. To remedy that shortage, the Army realigned the Reserve's force structure to include an Individuals Account with an allowance of 20,000 soldiers, representing 10 percent of total Reserve personnel. To accommodate the pool of reservists who would not be assigned to units within the total end strength of 205,000 soldiers, the Army had also reduced the size of the Reserve's operating force (to 129,000 soldiers) and generating force (to 56,000 personnel). That realignment would have provided for an Individuals Account equal to 20,000 soldiers.

12. As was the case with the National Guard, the Reserve's force structure requirements in 2003 exceeded the total number of personnel available to fill them. Specifically, the total personnel required to fill the Reserve's operating force—160,000—plus those needed to fill the generating force—60,000—exceeded the 205,000 soldiers authorized in 2003.

But, as with the other two components, the Army's plans for growth announced in 2007 will negate much of the previous realignment. Between 2007 and 2013, the Army now plans to add 1,000 soldiers to the Army Reserve. At the same time, however, it will increase the size of the operating force in the Reserve by 20,000 soldiers, doing so by reducing the size of the generating force by 11,000 soldiers and the Individuals Account by 8,000 (see Table 2-1 on page 29). As a result, the portion of total Reserve personnel assigned to the generating force will drop to 23 percent, significantly less than the 34 percent it represented in 2003. The planned Individuals Account of 12,000 personnel represents less than 6 percent of all Army Reservists, many fewer than under the originally proposed Individuals Account. As with the Guard and the active Army, the expectation that the Army can create more units in the Reserve by reducing the number of soldiers assigned to the generating force and in the Individuals Account may prove unrealistic.

How Much Will the Army's Transformation Programs Cost?

The Army will incur costs to reorganize its units and modernize its equipment, the two major components of its transformation effort. As it reorganizes and expands its force structure under the Modularity Initiative, the Army also will need to recruit and hire additional personnel and buy more equipment so that all of its units will be similarly outfitted. And, to modernize its combat units, the Army is developing new weapons and associated systems as part of the Future Combat Systems program. Because all of those efforts could take many years, the Army plans to modernize its existing systems so that they can remain effective for several more decades. All told, the costs to the Army for those programs could total more than \$400 billion from 2009 through 2030, CBO estimates.

Costs of the Modularity Initiative Included in the Previous Administration's 2009 Plan

The costs of the Army's Modularity Initiative can be considered in two parts: the costs of the original initiative, which included reorganizing the Army's units without the need for additional personnel; and the costs of the Grow the Army initiative, which, based on the 2009 plan, would have added six brigade combat teams and 74,000 personnel to the Army as a whole.

Modularity Initiative. Because the Army's new modular units are designed to be equipped and staffed differently from the units they are scheduled to replace, the Army will have to purchase equipment and build facilities to carry out the reorganization of its forces. According to CBO's estimates, the total cost of the restructuring would be \$40 billion from 2009 to 2013 (see Table 2-2).¹³ Most of that amount (\$34 billion) would procure equipment for the new units, including either newly purchased or refurbished Abrams tanks, Bradley fighting vehicles, trucks, and other support equipment, and large numbers of radios and other communications gear.

That estimate of procurement costs for the Modularity Initiative is based in part on the Army's most recent estimate—released by the Office of Management and Budget in January 2007—which included \$21 billion for procurement over the 2009–2011 period. The Army has said that it will need additional funding in 2012 and 2013 to purchase equipment for its modular units but did not specify the cost. CBO assumed that the Army would require funding for procurement in those years of \$6.5 billion—roughly equal to the average of funding required in 2010 and 2011—which yields total procurement funding from 2009 through 2013 of \$34 billion. The remaining costs are associated with building new facilities (for example, headquarters buildings and maintenance sheds) as new units are created or existing ones moved to new bases, and with purchasing supplies for sustainment and training (for example, fuel, ammunition for training, and other expendable goods). Those costs are in addition to the amounts that have already been provided for the Modularity Initiative: \$24 billion in procurement funds, \$1 billion for new facilities, and \$2 billion in operation and maintenance (O&M) funds for sustainment and training supplies. Although the Army has stated that it will probably require additional funding after 2013 to complete the transformation of its units to the modular structure, it has not stated any associated costs.

The Army's estimates of the total costs of its Modularity Initiative and of funds it has received to carry it out have both been the subject of debate. Although the Army's plans for its modular units have changed significantly

13. Those costs should be relatively unaffected by the changes announced by Secretary Gates in April 2009.

Table 2-2.

Costs of the Army's Transformation Programs Under the Previous Administration's 2009 Plan, 2005 to 2030

(Billions of 2009 dollars)

Program and Account	2005-2008	2009-2013	2014-2030	Total, 2005-2030
Modularity				
Modularity (Excluding Grow the Army)				
Operation and maintenance	2	2	^a	4
Procurement	24	34 ^b	^a	58
Construction	<u>1</u>	<u>4</u>	^a	<u>5</u>
Subtotal	27	40	^a	67
Grow the Army ^c				
Military personnel	6	25	93	124
Operation and maintenance	3	15	62	80
Procurement	4	10	^a	14
Construction	<u>2</u>	<u>9</u>	^a	<u>11</u>
Subtotal	15	59	155	229
Total, Modularity	42	99	155	296
Modernization				
Future Combat Systems (FCS) ^c				
RDT&E	14 ^d	12	2	27
Procurement	<u>0</u>	<u>8</u>	<u>94</u>	<u>103</u>
Subtotal	14	20	96	130
FCS Spin-Out Program				
RDT&E	*	*	*	*
Procurement	<u>*</u>	<u>3</u>	<u>15</u>	<u>18</u>
Subtotal	*	3	15	18
Combat Vehicle Modernization ^e				
RDT&E	*	1	1	2
Procurement	<u>11</u>	<u>6</u>	<u>47</u>	<u>64</u>
Subtotal	11	7	48	66
Total, Modernization	25	30	159	214

Source: Congressional Budget Office based on Government Accountability Office, *Force Structure: Better Management Controls Are Needed to Oversee the Army's Modular Force and Expansion Initiatives and Improve Accountability for Results*, GAO-08-145 (December 2007), p. 18; and Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and Marine Corps's Personnel Levels," letter to the Honorable Carl Levin (April 16, 2007); and data from the Department of the Army.

Notes: RDT&E = research, development, test, and evaluation; * = less than \$500 million.

Numbers may not add up to totals because of rounding.

- a. Unknown and assumed to equal zero.
- b. Includes \$21 billion for 2009 through 2011. The Army has not identified costs for 2012 and 2013. CBO's estimate includes annual costs in 2012 and 2013 of \$6.5 billion, which approximates the average spending planned for 2010 and 2011.
- c. Based on the Army's plans and programs prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- d. A total of \$2 billion was appropriated for RDT&E activities for the FCS program in 2003 and 2004.
- e. Includes upgrades to Abrams tanks, Bradley fighting vehicles, and M109 howitzers and purchases of Stryker vehicles to replace M113-based vehicles.

since the plan was announced in 2004, the costs have not been updated to reflect those changes, according to both the Government Accountability Office (GAO) and the Army.¹⁴ GAO reports that the Army plans to continue to request funding for equipment for modular units through 2017. Some of the additional funding that might be needed is no doubt reflected in CBO's inclusion of \$13 billion in funding requirements for 2012 and 2013 (an amount not reflected in the Army's estimates), but even more funding will be needed after 2013 in all likelihood.

Debate also surrounds the amount of required funding that the Army has received to date for the Modularity Initiative. In its reports to the Congress and its response to CBO's inquiries, the Army indicated that it had received \$4.9 billion in 2005 and \$4.7 billion in 2006 for its transformation effort.¹⁵ In subsequent years, however, the Army has stated that "Modularity has become integral to the Army" and that "There is no longer a distinguishable difference between equipment purchased for developing the modular force and modernized fielding."¹⁶ Furthermore, the Army has received funds to equip modular units from several sources: as part of funding requested specifically for the Modularity Initiative, as part of supplemental funding for the reset program that repairs and refurbishes equipment returning from Iraq and Afghanistan, and as part of the funding for modernization requested in President Bush's budget for 2009. GAO has reported repeatedly on the confusion resulting from the multiple requests for, and multiple sources of, funds for equipment for modular units.¹⁷ In a previous report, CBO noted that funds requested as part of the Army's reset efforts were being used to upgrade tanks and

Bradley fighting vehicles needed to equip its modular units.¹⁸

CBO estimates that the Army has received a total of at least \$57 billion in appropriated funds for 2005 through 2008 for equipment that could be used to equip modular units. That amount is more than twice the \$24 billion that the Army estimated equipment for its modular units would cost during the same period.

Grow the Army Initiative. The Army's planned expansion will result in higher annual costs for personnel and operations as well as for additional equipment and facilities. In CBO's estimation, the cost of the previous Administration's plan to add six BCTs, associated support units, and 74,200 military personnel is \$59 billion from 2009 through 2013.^{19,20} That total includes \$25 billion for military personnel and \$15 billion for operation and maintenance of the additional units. About \$3 billion of the increase in O&M costs is attributable to the Army's plan to use 16,000 civilians to fill some jobs currently assigned to military personnel in order to free up soldiers for its operating force. Those annual costs for additional military personnel, full-time civilians, and operations for new units will continue even after the Army has completed its expansion, adding about \$9 billion to the Army's annual budget after 2013.

14. Based on Government Accountability Office, *Force Structure: Better Management Controls Are Needed to Oversee the Army's Modular Force and Expansion Initiatives and Improve Accountability for Results*, GAO-08-145 (December 2007), p. 18; and a private communication from the Army to CBO.

15. Based on Department of the Army, *Annual Report on Army Progress* (February 2007); and a private communication from the Army to CBO. Funds cited in the text are in fiscal year 2009 dollars.

16. Department of the Army, *2008 Report to Congress on Progress for the Modular Force Initiative* (February 27, 2008), p. 3.

17. See Government Accountability Office, *Force Structure*, p. 23, and *Defense Logistics: Army and Marine Corps Cannot Be Assured that Equipment Reset Strategies Will Sustain Equipment Availability While Meeting Ongoing Operational Requirements*, GAO-07-814 (September 2007).

18. See Congressional Budget Office, *Replacing and Repairing Equipment Used in Iraq and Afghanistan: The Army's Reset Program* (September 2007).

19. See Congressional Budget Office, "Estimated Cost of the Administration's Proposal to Increase the Army's and the Marine Corps's Personnel Levels," letter to the Honorable Carl Levin (April 16, 2007).

20. Those costs account for the addition of six BCTs to the active Army. Secretary Gates announced in April 2009 that the addition will be reduced from six BCTs to three BCTs. He did not, however, announce any changes to the planned increase in end strength. Changes in the costs associated with the Grow the Army initiative, therefore, would be associated with the purchase of equipment and building of facilities for the three BCTs included in CBO's estimate that, based on the current Administration's 2010 plan, will not be added to the Army.

The costs to equip the new units and build facilities for them will occur only once and thus will account for a much smaller portion of the total cost from 2009 through 2013.²¹ CBO estimates that the total cost for equipment from 2005 through 2013 will be \$14 billion, of which \$10 billion will be needed from 2009 through 2013 (see Table 2-2 on page 33). The total cost for facilities will be \$11 billion, \$9 billion of which will be needed between 2009 and 2013.

When all the costs associated with the GTA initiative are combined, the total from 2009 through 2030 could exceed \$200 billion, CBO estimates. The bulk of those costs—\$118 billion—would pay for additional personnel, demonstrating that creating additional new units, as this portion of the Army's Modularity Initiative does, is substantially more expensive than merely reorganizing existing ones.

Costs of the Major Modernization Efforts Included in the Previous Administration's 2009 Plan

CBO examined three modernization programs that are closely tied to the Army's transformation effort. Two are related to the FCS program—the FCS program itself, which, based on the 2009 plan, would have developed and procured 14 systems and a network to equip 15 BCTs, and the Spin-Out program, which, based on plans as of the end of 2008, was designed to procure and field selected FCS components to 43 IBCTs.

The final modernization effort that CBO examined in detail involves the Army's programs to modernize and upgrade the armored combat vehicles in its HBCTs. CBO chose to examine that effort—specifically, programs to improve the Abrams tanks, Bradley fighting vehicles, and Paladin howitzers so that they can remain effective until at least 2040—as opposed to other modernization efforts, for several reasons. First, one of the goals of the original FCS program was to replace all of the Army's armored combat vehicles by 2030, thereby negating the need for a modernization program. Thus, in some ways, the FCS program and armored vehicle modernization efforts are interrelated. Second, the Modularity Initiative drove, to some extent, the Army's efforts to mod-

ernize its tanks and Bradley fighting vehicles in numbers sufficient to equip all HBCTs to one of two standards. And, finally, programs to modernize the Army's combat vehicles commanded a greater share of the Army's procurement funds between 1980 and 2005 than programs to modernize any other type of equipment.

The FCS Program. The total costs through 2030 of the FCS program included in the previous Administration's 2009 plan would have exceeded \$130 billion, with the bulk of those costs coming due after 2013.²² The program, which has been in existence since 2003, had already incurred \$16 billion in costs to develop the various FCS technologies by 2008. An additional \$14 billion would have been needed to complete that development—all but \$2 billion before 2014—according to the latest estimates from the Army (see Table 2-2). Most of the costs associated with the program, however—more than \$100 billion—would have been to purchase 15 brigades' worth of FCS equipment. Although \$8 billion would have been needed before 2014 to purchase long-lead items and prototypes of the FCS cannon, the bulk of the costs—\$94 billion—would have been incurred from 2014 to 2030.

The FCS Spin-Out Program. The Army intends to start purchasing some FCS components for fielding to IBCTs in 2010. On the basis of plans as of August 2008, the Army would buy enough hardware—specifically all of the FCS components except for manned vehicles and some unmanned vehicles, and equipment for the network, although in lower quantities than would have been fielded to FBCTs—each year to equip from two to four brigades. The total cost to equip the 43 IBCTs included in the Spin-Out program at the end of 2008 would be \$18 billion, the Army estimates, and more than 80 percent of the cost would come due after 2013 (see Table 2-2).

Modernization of Armored Combat Vehicles. The Army planned to retain large numbers of Abrams tanks, Bradley fighting vehicles, and Paladin howitzers in its inventory even after it had fielded 15 FBCTs. Until 2016, when the Army had previously planned to begin fielding those brigades, it will need to retain 2,600 Abrams tanks,

21. Additional costs for facilities and equipment may be incurred after 2013, but CBO has not received sufficient information from the Army to estimate them.

22. Costs for the FCS program are based on information reported in the December 2007 SAR.

4,500 BFVs, and 900 Paladin howitzers.²³ Once it had completed fielding FCS brigades in 2030, the Army would still have had 11 HBCTs equipped with tanks and other tracked combat vehicles. According to CBO's estimates, equipping and supporting those BCTs would have required 1,300 tanks, 2,300 BFVs, and 600 Paladin howitzers.²⁴

The Army has several programs to develop and procure improved electronics, engines, armor, and other components for insertion into its existing armored combat vehicles, but some of those programs, particularly for activities after 2013, are not well defined. Between 2005 and 2008, the Army invested \$11 billion in upgrading its tanks, BFVs, and M113-based vehicles. It plans to invest considerably less—\$6 billion—from 2009 through 2013, according to documents submitted with the President's 2009 budget. The Army has expressed a desire to upgrade many of the tanks, Bradley fighting vehicles, and Paladins that would have remained in its BCTs even after all FCS equipment had been fielded in 2030, but it has outlined a specific program to do so only for the 600 howitzers it plans to retain, at a total cost of \$3 billion. On the basis of preliminary information, CBO estimates that the total cost between 2014 and 2030 to upgrade the Army's tanks and Bradley fighting vehicles needed to support those BCTs that would not have been equipped with FCS vehicles could be as high as \$27 billion.

The Army's future plans for its M113-based vehicles are more uncertain. Although the Army has stated that it would like to replace all of its M113-based vehicles with Stryker vehicles, the cost could be significant—roughly \$18.5 billion, in CBO's estimation.²⁵ The Army could modernize the vehicles instead, although materials submitted with the President's 2009 budget indicate that the Army does not plan to do so. Therefore, based on CBO's

estimates, the potential cost from 2014 through 2030 for programs to modernize and upgrade the major combat vehicles that the Army plans to retain in its heavy brigades and to replace the M113s with Strykers could approach \$48 billion. When combined with funds devoted to such modernization programs from 2009 through 2013, the total cost from 2009 through 2030 could reach \$55 billion.

Are the Army's Transformation Programs Meeting Their Goals?

The Army's transformation programs have achieved some of their initial goals, but generally only at a higher cost or over a longer time frame than was originally projected. Many of the goals have been altered or abandoned altogether.

The Army's Modularity Initiative has created more combat units, which can be used to ease the strain of repeated deployments. But the units have not been created without the need for additional personnel—in contradiction of an early claim of the initiative. Also, the conversion of units to modular designs has not been accomplished as quickly as was originally planned, and it will take the Army at least seven years beyond the initial schedule to complete it. The goal of having only three types of units is gradually being abandoned, as variants of the HBCTs and IBCTs are fielded. And, even without the need to pay for additional personnel, the cost of the Modularity Initiative has far exceeded the originally estimated price tag of \$21 billion.

The FCS program, too, has fallen short of its original goals. Initially touted as a means for transforming all of the combat units in the Army, the FCS program, as conceived at the end of 2008, would have fully equipped fewer than 20 percent of the Army's combat units. Another goal, to make heavy combat units more easily transportable, has proven infeasible. FCS units would have contained almost as many combat vehicles and only 25 percent fewer trucks as units equipped with current armored vehicles.²⁶ Consequently, compared with an HBCT, an FBCT would have required less than 5 percent fewer airlift sorties to move it overseas. By the end of

23. CBO estimates that the Army also may need to retain 6,800 M113-based vehicles, but it currently has no plans to modernize them.

24. The reduction in fleet inventories is not proportional to the reduction in fielded brigades because CBO assumes that the Army will retain an additional five brigades' worth of equipment stationed around the world in case of crises. Furthermore, Paladin howitzers are needed to equip artillery brigades, in addition to HBCTs.

25. That estimate is based on the assumption that the 4,800 M113-based vehicles that CBO expects will be needed to support the Army's forces in 2030 would be replaced with an equal number of Stryker vehicles.

26. That comparison includes the large unmanned ground vehicles—which are projected to weigh 3.5 tons—in the tally of trucks in an FBCT. If those vehicles are excluded, an FBCT would contain 590 trucks, or roughly 33 percent fewer than an HBCT.

2008, the original cost estimates had been exceeded by 50 percent. And, because of the high cost of FCS and other modernization efforts included in the previous Administration's 2009 plan, many BCTs would have been equipped with varying mixes of FCS components and modernized combat vehicles, further diluting the ideal of standardized units.

By the end of 2008, the increasing costs to complete development of the FCS technologies and to purchase all 14 of the components and the accompanying network in sufficient numbers to equip an entire BCT had slowed the fielding of FBCTs to the point at which the last one

would not have been in place until 2030. That delay has made necessary what the Army had at one time hoped to avoid—the need to invest in costly and continuing upgrades to its existing combat vehicles.

CBO investigated three alternative ways that the Army could continue to modernize its forces, but at a lower cost. The next chapter lays out those alternatives—one of which closely parallels Army modernization plans that would result from changes announced by Secretary Gates in April 2009—and examines their advantages and disadvantages when compared with the Army's plans in place as of the end of 2008.

Alternative Approaches to Modernizing the Army's Combat Forces

The Congressional Budget Office analyzed three alternatives for modernizing the Army's combat forces that would address concerns about the Future Combat Systems program, as described in the previous Administration's 2009 plan, including its affordability and the slow rate of introduction of FCS components into the Army's units. (These options are similar to several that CBO analyzed when it last examined the FCS program several years ago.)¹ Two of the alternatives would retain various portions of the FCS program while canceling the remainder. The third alternative would cancel development and procurement of the program's new weapon systems but retain the FCS network and associated software and integration elements.

The two options that would retain significant portions of the FCS program—Alternatives 1 and 2—were structured to take advantage of different aspects of the technologies under development (see Table 3-1). Under the first alternative, which emphasizes nonvehicular technologies, the Army would develop and purchase the full suite of FCS sensors—the unattended ground sensors and both classes of unmanned aerial vehicles, together with the network—to enhance units' ability to collect and disseminate information. The Army would also develop and purchase the small unmanned ground vehicle (used to collect information in small, dangerous locations) and the non-line-of-sight launch system.

Under the second alternative, the Army would emphasize vehicular technologies. The Army would focus on enhancing the maneuverability and surveillance capability of its heavy brigade combat teams by developing several of the manned FCS ground vehicles—particularly

those that would replace the older M113-based vehicles and M109 self-propelled howitzers currently in the Army's fleet—as well as the network to tie them together. Under the third alternative, the Army would develop only the network and forgo acquisitions of any other FCS components.

Under all three alternatives, the Army would replace any remaining M113-based vehicles with Stryker vehicles and upgrade existing armored vehicles to convert them to the latest models and prevent their average age from rising. Those modernization efforts would also integrate any capabilities gained from the various FCS components that were retained—once those systems became available. Under none of the alternatives would the Army develop or procure the larger unmanned ground vehicles that are currently planned for the FCS program.

CBO's analysis is based largely on modernization plans for Army transformation programs as outlined in documents that the Bush Administration submitted to the Congress in conjunction with its fiscal year 2009 budget request. In early April 2009, Secretary of Defense Robert M. Gates outlined changes to plans for the FCS program that he recommended be incorporated into the Obama Administration's fiscal year 2010 defense budget request. Although the 2010 request was submitted shortly before CBO published this report, that request did not contain sufficient programmatic details to allow CBO to completely reassess the FCS program. Moreover, the Administration announced that, unlike previous budget requests, the fiscal year 2010 request would not be accompanied by revised and updated Selected Acquisition Reports, which would have supplied programmatic details for years after 2010. For those reasons, CBO's analysis of the FCS program relied on its most recent SAR, submitted in

1. See Congressional Budget Office, *The Army's Future Combat Systems Program and Alternatives* (August 2006).

Table 3-1.

Emphasis of and Components Included in Modernization Alternatives for the Army

Alternative	Emphasis	FCS Components ^a	
		Retained	Canceled
Alternative 1	Information collection and sharing	Scaled-down network UAVs, Classes I and IV Unattended ground sensors Small unmanned ground vehicle Non-line-of-sight launch system	Manned vehicles (All) Large unmanned ground vehicles (All)
Alternative 2	New vehicular technology	Scaled-down network Manned vehicles Medical Infantry carrier ^b Non-line-of-sight mortar Non-line-of-sight cannon Command and control	Unmanned ground vehicles (All) Manned vehicles Mounted combat system FCS recovery and maintenance Reconnaissance and surveillance UAVs, Classes I and IV Non-line-of-sight launch system Unattended ground sensors
Alternative 3 ^c	Current systems	Scaled-down network	Manned vehicles (All) Unmanned ground vehicles (All) UAVs, Classes I and IV Unattended ground sensors Non-line-of-sight launch system

Source: Congressional Budget Office.

Note: FCS = Future Combat Systems; UAV = unmanned aerial vehicle.

- Based on systems included in the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- Under Alternative 2, the Army would buy roughly 25 percent of the infantry carrier vehicles included in the Administration's plan.
- Alternative 3 includes two variants that connect different quantities of vehicles in a brigade combat team to the network.

December 2007, to analyze the cost, schedule, and effects of the FCS program on the Army's forces.

Although details concerning the revised FCS program will most likely not be available until the fall of 2009, the general outlines for that program were included in Secretary Gates's announcement. The changes he announced, including the cancellation of the manned vehicle portion of the FCS program and an acceleration of the introduction of spin-out technologies into the Army's BCTs, closely parallel the changes in the program that are included in Alternative 1.² Thus, although the program described in Alternative 1 and the FCS program included

in the Obama Administration's 2010 budget are most likely not identical, CBO's analysis of the effects of Alternative 1 on the Army's forces should yield some insight into the likely impact of a restructured FCS program as outlined by Secretary Gates.

CBO used several measures to evaluate the previous Administration's 2009 plan for the Future Combat Systems program and its armored vehicles, as well as each of the alternatives: total and annual costs, the effect on the age of the Army's armored vehicle fleet, and the rate and extent to which FCS technologies would be introduced into the Army's combat brigades.³ In estimating costs,

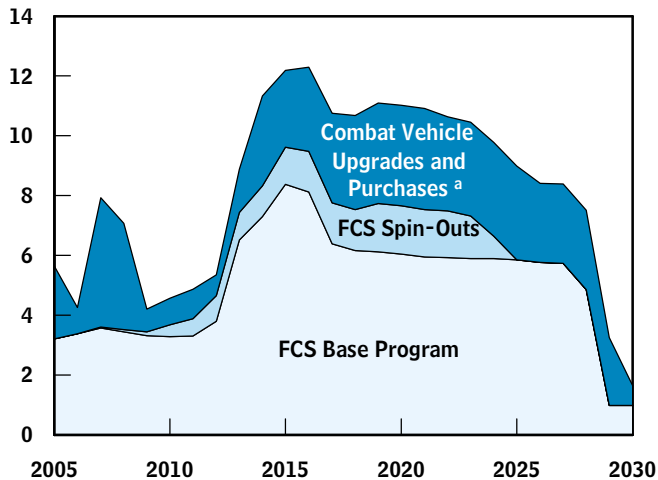
2. It should be noted that, unlike the Army's Spin-Out program, CBO's Alternative 1 does not field any of the large multi-functional utility/logistics and equipment unmanned ground vehicles included in the FCS program.

3. Because this analysis used the previous Administration's 2009 plan as a reference, CBO analyzed the effect of the alternatives on the 76 BCTs that the Army expected to field on the basis of that plan.

Figure 3-1.

Annual Costs of the Army's Modernization Programs Under the Previous Administration's 2009 Plan

(Billions of 2009 dollars)



Source: Congressional Budget Office based on Office of the Secretary of Defense, *Future Combat Systems: Selected Acquisition Report* (December 31, 2007); and budget data from the Department of the Army.

Note: FCS = Future Combat Systems.

- a. Funding in addition to that included in the previous Administration's 2009 plan is provided to pay for upgrades to or purchases of armored combat vehicles to maintain a relatively constant average age of the fleets after 2013.

CBO gauged the funds needed annually during the 2009–2030 period to develop and purchase the necessary systems. To discern how procuring large numbers of FCS vehicles would affect the armored combat fleet, CBO evaluated the impact of that procurement on the fleet's average age from 2010 through 2030. Last, CBO examined the rate at which each of the alternatives and the previous Administration's 2009 plan would introduce FCS-developed technologies—specifically sensors and networking capability—into the Army's combat brigades over the 20 years starting in 2010.

Costs and Effects of the Previous Administration's 2009 Plan Through 2030

The total costs of the FCS program included in the 2009 plan and its related Spin-Out program could have exceeded \$130 billion between 2009 and 2030. During

the next decade alone, costs of those two programs would have commanded a significant portion of the Army's annual acquisition budget. The bulk of the costs would have come due after 2013; annual costs would have peaked at about \$9.5 billion in 2015 and 2016, when the first two full brigades' worth of FCS equipment was scheduled to be purchased (see Figure 3-1). A large part of those costs—roughly \$9 billion—would have been for procurement, because most of the funds to develop FCS components would have been provided previously. Although it is impossible to know what the Army's total procurement budget will be in 2015 or 2016, if it is similar to the \$24 billion planned for procurement in 2013, the amount commanded by FCS and its Spin-Out program would have represented almost 40 percent of the total.⁴ Some analysts have questioned whether the Army would have been able to devote such a large portion of its procurement funds to one program when it also has many other programs to support.

Effects of the Previous Administration's 2009 Plan on the Age of Armored Combat Vehicles

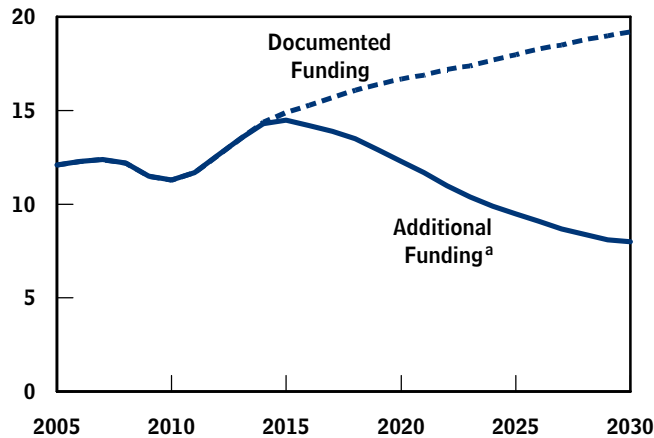
The fielding of the entire complement of 15 fully equipped Future Combat Systems brigades would not have been completed until 2030 according to the previous Administration's 2009 plan. Although each fielded brigade would have replaced more than 300 of the Army's combat vehicles with FCS manned vehicles, the slow rate of introduction would not have been able to keep the Army's combat vehicles from becoming obsolete. For that reason, the Army has several programs designed to maintain the capability and technical sophistication of its vehicles. Those programs—designed to upgrade the Abrams tanks, Bradley fighting vehicles, and M109 Paladin howitzers and to replace the M113-based vehicles with Stryker vehicles—could cost a total of \$55 billion between 2009 and 2030 according to CBO's estimates. The combined effects of the Army's vehicle modernization and FCS programs, if fully funded, could have yielded a combat vehicle fleet with an average age that remained below 15 years through 2030, well within or below the desired maximum average age of 10 years to 15 years (see Figure 3-2).

4. To put that assumption in historic context, the Army's procurement budget has experienced several peaks and valleys since 1960. However, procurement funding in two-thirds of those years was less than that planned for 2013. The average procurement funding between 1960 and 2013 is \$19 billion, \$5 billion less than that planned for 2013.

Figure 3-2.

Average Age of the Armored Combat Vehicle Fleet Under the Previous Administration's 2009 Plan

(Average age, in years)



Source: Congressional Budget Office based on budget data from the Department of the Army.

a. Additional funding would pay for upgrades to and purchases of armored combat vehicles needed to keep the average age of the fleets relatively constant after 2013.

The Army has not identified funding to carry out most of its programs to upgrade and modernize its combat vehicles after 2013. In documents submitted with the President's 2009 budget—specifically, the Selected Acquisition Report for the Stryker program—no funds were identified to purchase vehicles to replace the 6,800 M113-based vehicles that CBO estimates the Army needs to equip its units. Nor were any Bradley fighting vehicles scheduled to be upgraded after 2014. Similarly, no funds for major upgrades for the Abrams tank or M113-based vehicles are identified after 2012 and 2008, respectively. The only program that supports major upgrades, continues well past 2015, and is described in material accompanying the 2009 budget is the one that upgrades 600 M109 howitzers.

If only those programs that are identified in budget documents as having funds are actually carried out, the Army's combat vehicle fleet could exceed the maximum desirable age as early as 2016. Even with the introduction of 15 brigades' worth of FCS vehicles and planned upgrades to Paladins, the average age of the Army's combat vehicle fleet could have approached 19 years by 2030 unless the

significant investment needed to upgrade or replace current vehicles—\$48 billion between 2014 and 2030, in CBO's estimation—was made (see Figure 3-2).

Effects of the FCS Program and Its Spin-Outs on Technologies in the Army's Combat Brigades

The FCS program was originally intended to inject new technologies into the Army's combat brigades early in the 21st century. As fielding of the FCS technologies slipped farther into the future, however, the Army created the Spin-Out program to field smaller quantities of some technologies as soon as they became available. As structured in the previous Administration's 2009 plan, those two programs combined aimed to equip 53 of the Army's planned 76 brigade combat teams with some FCS technologies by 2025. At that time, however, only 10 BCTs would have had the full set of FCS equipment and would have had more than a third of their vehicles, including all 322 combat vehicles, tied into the FCS network. The remaining BCTs—which, under the 2009 plan, would have been 43 infantry units—would have had less than 10 percent of all their vehicles fully integrated into the network.

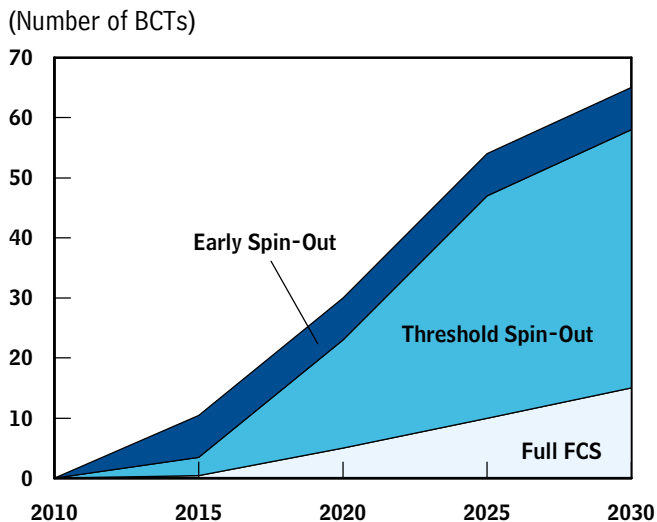
A similar situation applies to the unmanned aerial vehicles and other sensors being developed in the FCS program. Under the previous Administration's 2009 plan, 53 BCTs would have had some UAVs, unattended ground sensors, and other FCS components by 2025, but only 10 would have been equipped with the full complement of systems (see Figure 3-3). Thus, the previous Administration's 2009 plan would have fielded small numbers of FCS components to the Army's IBCTs quickly in the next 15 years but would have fully equipped only 15 Future Combat Systems BCTs by 2030.

Alternative 1: Accelerate and Expand the Fielding of Technologies Through the Spin-Out Program

This alternative, which is similar to the revised program outlined by Secretary Gates in his April 2009 announcement, would focus on developing those FCS components that are less technically challenging and that will enhance a combat brigade's ability to detect and attack potential threats. Some people argue that with more extensive knowledge of the location and character of potential threats and the whereabouts of friendly forces, Army

Figure 3-3.

Fielding of FCS Technologies to Brigade Combat Teams Under the Previous Administration's 2009 Plan



Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; FCS = Future Combat Systems.

units would be better able to respond and act appropriately, either individually or in concert. Toward that end, the Army under this alternative would accelerate the fielding of the unmanned ground sensors, both classes of unmanned aerial vehicles, and the small unmanned ground vehicle (see Table 3-1 on page 40). In addition, the Army would field the non-line-of-sight launch system so that the BCTs would be able to attack targets detected by the sensors. It would also retain the network portion of the FCS program so that information gathered by the sensors could be shared with all members of the brigade.

The systems would be fielded in roughly the same number per BCT as is envisioned in the Army's Spin-Out program, but they would be fielded to all types of BCTs, including heavy and Stryker units. All other FCS components, including the manned and the larger unmanned ground vehicles, would be canceled. Under this alternative, the Army would upgrade its existing Abrams tanks, Bradley fighting vehicles, and M109 howitzers to maintain their effectiveness for the next 20 years to 30 years. It would also replace the M113-based vehicles in the Army's inventory with Stryker vehicles and would integrate roughly the same number of vehicles in each brigade into

the FCS-based network as envisioned in the Army's FCS Spin-Out program.

By introducing the sophisticated sensors developed in the FCS program into the Army's combat brigades, this alternative could significantly enhance the information available to soldiers and commanders in the field about the location of enemy units, friendly forces, civilians, and features of the terrain—as well as about events as they unfold.

- The Class I UAVs, which are designed to be operated by one- or two-person teams, could allow individual soldiers to scout nearby terrain, even in an urban setting. The Class IV UAV would slightly extend the range of the brigade's UAV coverage from that provided by the current Shadow UAV (roughly 50 kilometers) to 75 km. All told, adding 22 Class I UAVs and four Class IV UAV launchers with four aerial vehicles each could roughly double the number of such vehicles assigned to a combat brigade.
- The unmanned ground sensors, when widely dispersed, could provide remote early warning of any intruders on the ground or in the air over an area of up to 1 square kilometer.
- The small unmanned ground vehicle could provide soldiers with the ability to scout small, dangerous, or confined spaces without endangering their lives.
- The non-line-of-sight launch system and its associated munitions could extend a BCT's ability to strike targets at ranges of up to 70 km, allowing the team to engage and defeat an enemy force while still beyond the range of enemy weapons.
- Consoles and receivers to integrate vehicles into the FCS network, which would be installed in 6 percent to 9 percent of the vehicles in BCTs, would allow the information collected by the numerous sensors to be disseminated throughout the BCT.⁵

5. Seventy-five vehicles—51 combat vehicles and 24 high mobility multipurpose wheeled vehicles—in each heavy or Stryker brigade and 80 HMMWVs in each infantry brigade would be fully integrated into the network under this alternative. Those figures are based loosely on the Army's plans for integration of FCS technologies into BCTs in its plans for the Spin-Out program submitted with the President's 2009 budget and revisions as of August 2008.

Table 3-2.

Costs of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives, 2009 to 2030

(Billions of 2009 dollars)

	Research and Development	Procurement	Total Acquisition
Administration's Plan^a			
FCS Program ^b	14	103	117
FCS Spin-Out Program	*	18	18
Upgrades to Current Systems			
Explicitly included in the Administration's plan	1	8	9
CBO's estimate of additional upgrades included in the Administration's plan ^c	1	45	46
Total	16	173	189
Alternative 1. Emphasize Information Collection and Sharing			
FCS Components ^d	10	21	31
Upgrades to Current Systems ^c	2	63	65
Total	12	84	96
Alternative 2. Emphasize New Vehicular Technology			
FCS Components ^e	12	64	76
Upgrades to Current Systems ^c	2	55	57
Total	14	119	133
Alternative 3. Cancel the FCS Program (Except the network)			
Alternative 3A: Link All Combat Vehicles			
FCS network	9	32	41
Upgrades to current systems ^c	2	63	65
Total	11	95	106
Alternative 3B: Link a Fraction of Combat Vehicles			
FCS network	9	9	18
Upgrades to current systems ^c	2	63	65
Total	11	72	83

Source: Congressional Budget Office based on data from the Department of the Army.

Note: FCS = Future Combat Systems; * = less than \$500 million.

- a. Based on the FCS program prior to changes announced by Secretary of Defense Robert M. Gates in April 2009.
- b. Includes costs to develop and purchase 15 brigades' worth of FCS components—enough to equip almost 60 percent of the Army's planned 26 heavy brigades (19 brigades in the active Army and 7 brigades in the Army National Guard).
- c. Includes upgrades to Abrams tanks, Bradley fighting vehicles, and M109 howitzers to maintain a relatively constant average age for each fleet after 2013, and purchases of Stryker vehicles to replace M113-based vehicles.
- d. Includes unattended ground sensors, unmanned aerial vehicles (Classes I and IV), non-line-of-sight launch systems, small unmanned ground vehicles, and the network.
- e. Includes manned vehicles (command and control, medical, non-line-of-sight mortar, non-line-of-sight cannon, and infantry carrier) and the network.

To operate effectively with the new FCS components and network and to keep the average age of the vehicle fleet within desirable bounds, the Army under this alternative would continually upgrade the armored combat vehicles that now equip its heavy BCTs. Each year, the Army would need to upgrade roughly 370 ground combat vehicles and purchase as many as 700 Stryker vehicles to meet that goal, in CBO's estimation.

Costs and Procurement Schedule Under Alternative 1

Under this option, the Army would spend a total of \$96 billion on modernization programs from 2009 through 2030, a substantially smaller amount than the \$189 billion that the previous Administration's programs (as described in material accompanying the 2009 budget) are estimated to cost over the same period. According to CBO's calculations, the cost of the FCS components developed and purchased under Alternative 1 would be \$31 billion (\$10 billion for research and development and \$21 billion for procurement), and the total cost of upgrading the existing armored combat vehicle fleet and purchasing Stryker vehicles (including the cost for R&D) would be \$65 billion (see Table 3-2). The annual costs of implementing Alternative 1 would be between \$4 billion and \$8 billion from 2012 to 2020. In comparison, the total annual costs estimated for the FCS program and its Spin-Out program plus upgrades to existing systems under the previous Administration's 2009 plan would be \$6 billion to \$12 billion over the same period (see Figure 3-4).

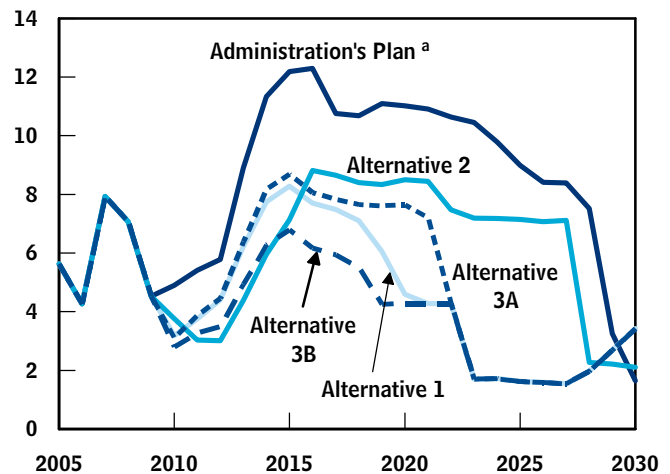
Under this alternative, procurement of sensors for the Army's BCTs would proceed at a faster pace than that planned by the Army. Starting in 2014, the Army would purchase components at a rate of 12 brigades' worth per year—three times the rate of purchases that the previous Administration planned as of August 2008. At that rate, the Army would have purchased enough components by 2020 to equip all 76 BCTs with most FCS sensors.⁶

6. Class IV UAVs are not scheduled to be available for purchase until 2013. Under Alternative 1, a total of 21 brigades' worth of those UAVs would be purchased in 2019 and 2020.

Figure 3-4.

Annual Costs of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives

(Billions of 2009 dollars)



Source: Congressional Budget Office.

a. Includes CBO's estimates of costs of additional upgrades to and purchases of armored combat vehicles to maintain a relatively constant average age of the fleets after 2013.

Effects of Alternative 1 on the Army's Fleet of Armored Vehicles

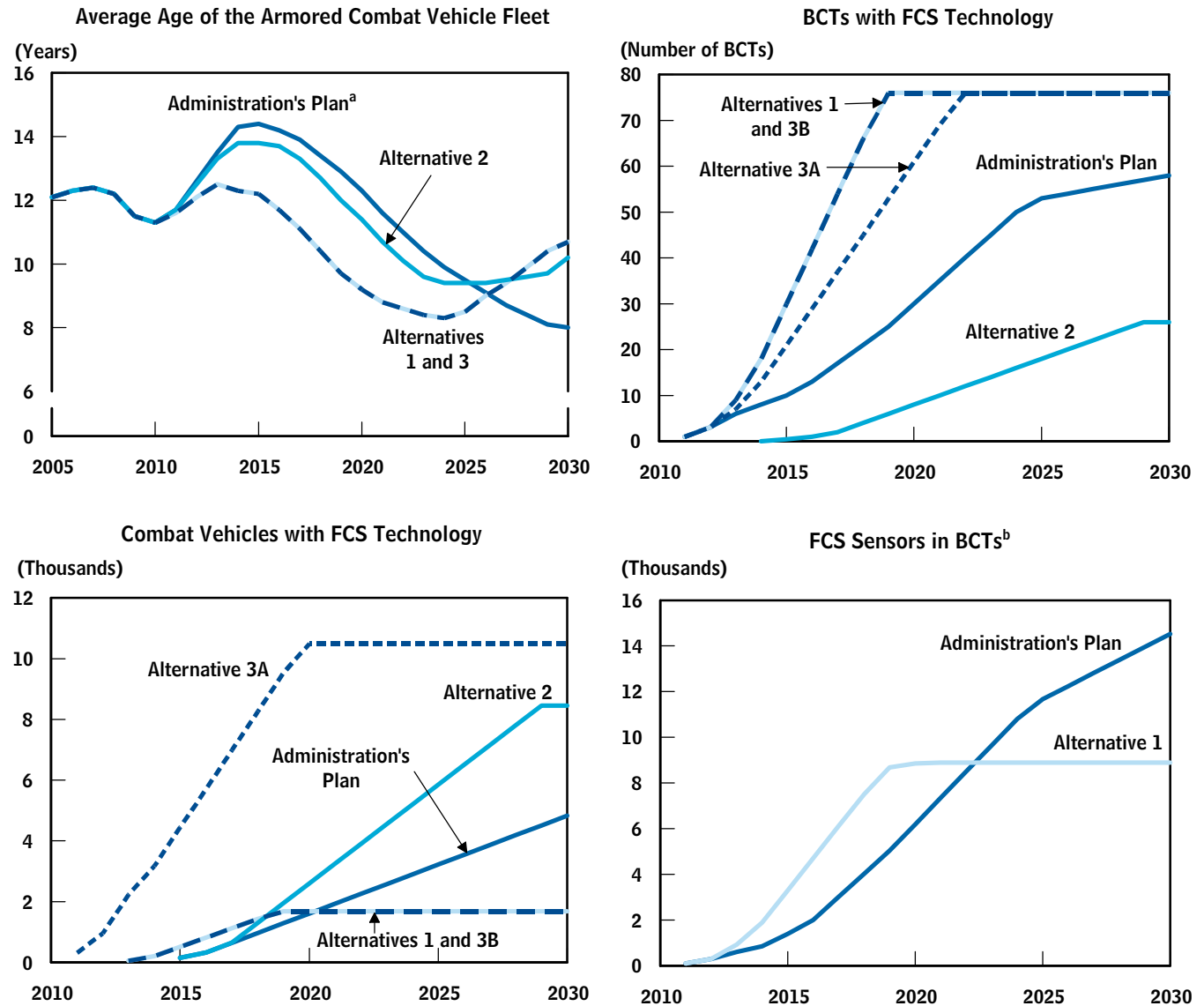
This alternative, like the previous Administration's 2009 plan with additional upgrades and the remaining two alternatives, would invest heavily in the Army's armored combat vehicle fleet. Under Alternative 1, the size of the fleet needed to equip and support the Army's combat units would remain relatively unchanged at roughly 14,800 vehicles between 2013 and 2030.⁷ Its composition would change only slightly over that period, with Stryker vehicles replacing M113-based vehicles. The fleet's average age would also remain relatively constant—between 8 years and 12 years—because the Army would invest \$65 billion in upgrades to its current vehicles from 2009 through 2030.

By contrast, under the previous Administration's 2009 plan even with additional upgrades funded, the average

7. For a detailed discussion of the Army's armored combat vehicle fleet, see Congressional Budget Office, *The Army's Future Combat Systems Program and Alternatives*.

Figure 3-5.

Comparison of the Army's Modernization Programs Under the Previous Administration's 2009 Plan and CBO's Alternatives



Source: Congressional Budget Office based on data from the Department of the Army.

Note: BCT = brigade combat team; FCS = Future Combat Systems.

- Includes CBO's estimate of costs of additional upgrades to and purchases of armored combat vehicles to maintain a relatively constant average age of the fleets after 2013.
- Includes unmanned aerial vehicles, unattended ground sensors, small unmanned ground vehicles, and armored robotic vehicles-assault-light. Under Alternatives 2 and 3, the Army would not purchase any FCS sensors.

age of the active armored combat vehicle fleet would have increased to more than 14 years in 2015 and then eventually declined, as FCS vehicles replaced significant numbers of the older Abrams tanks, Bradley fighting vehicles, M113-based vehicles, and M109 howitzers (see Figure 3-5).

Effects of Alternative 1 on Technologies in the Army's Combat Brigades

This alternative would introduce FCS-based technologies into all of the Army's BCTs and at a faster pace than the previous Administration's 2009 plan (see Figure 3-5). By doing so, this alternative would achieve the Army's stated goal of placing new technologies in the hands of soldiers. Prototypes of the small unmanned ground vehicle and Class I UAV are already being used in operations in Iraq and Afghanistan. Furthermore, this alternative would field the sensor technologies at a lower annual cost than the previous Administration's 2009 plan because it implements the FCS technologies on a smaller scale. The cost of FCS equipment for each combat brigade under Alternative 1 is roughly 5 percent that of a full BCT's worth of FCS equipment.

Because no full FBCTs would be fielded under this alternative, the total number of FCS sensors and combat vehicles attached to the network would be lower than under the previous Administration's 2009 plan. Under this alternative, each BCT would receive 38 UAVs, 41 unmanned ground sensors, and 38 SUGVs. In contrast, a full FBCT would be equipped with 122 UAVs, 359 unmanned ground sensors, and 81 SUGVs. As a result, by 2030, when the 15 full FBCTs would have been fielded under the previous Administration's 2009 plan, they would have contained 70 percent more sensors than all 76 brigades under this alternative. Similarly, all 322 combat vehicles in an FBCT would have been connected to the network under the previous Administration's 2009 plan, whereas only 51 combat vehicles would be connected to the network in each heavy or Stryker brigade under Alternative 1—the same number as was previously planned in the Spin-Out program. Thus, in comparison with the number of combat vehicles that would have eventually been connected to the network under the previous Administration's 2009 plan, this alternative would connect about 65 percent fewer.

Advantages and Disadvantages of Alternative 1

The major advantage of Alternative 1 is that it would allow the Army to introduce new technology into its

units more widely and more rapidly than under the previous Administration's 2009 plan and at a lower cost. This alternative would field some of the least technologically risky and least expensive FCS components (UAVs, unattended ground sensors, and the NLOS-LS). Consequently, it could purchase them at rates three times as high (12 brigades' worth of equipment per year) as the maximum annual purchases that were planned by the previous Administration in its Spin-Out program. As a result, by 2020, the Army under this alternative would purchase enough UAVs, unattended ground sensors, NLOS-LS, SUGVs, and network systems to equip all of its BCTs, albeit in quantities much lower than those planned for the 15 fully equipped FBCTs.

One disadvantage of Alternative 1 is that the Army would retain indefinitely its full inventory of Abrams tanks, Bradley fighting vehicles, and M109 howitzers. Even though the Army would invest \$65 billion to upgrade them, by 2030, some of those vehicles would have been in the Army's inventory for almost 50 years. Another disadvantage is the technical risk involved in introducing network technology and associated communications links into older systems. Previous attempts to upgrade the electronic suites (including communications and data processing equipment) in Abrams tanks and Bradley fighting vehicles have had some difficulties. Indeed, the Army delayed indefinitely the introduction of FCS network equipment into its combat vehicles when it restructured its Spin-Out program in the summer of 2008, possibly because of technical difficulties. A third disadvantage under this alternative (and the others that CBO considered) is that none of the Army's combat brigades would include the full complement of FCS technologies, which the Army argues is necessary to realize their full benefit.

Alternative 2: Emphasize Investment in New Manned Combat Vehicles

Under this alternative, the Army would develop and procure new vehicles to replace many of its oldest combat vehicles. The new vehicles would include most, but not all, of those already under development in the previous Administration's FCS program—specifically, the FCS command-and-control vehicle, non-line-of-sight mortar, medical evacuation and treatment vehicle, infantry carrier, and non-line-of-sight cannon. When combined with purchases of new Stryker vehicles, those FCS vehicles could eventually replace all of the M113-based vehicles

and M109 howitzers needed to support the Army's planned force structure.

The FCS vehicles would address at least some of the problems that the Army has said are associated with keeping older vehicles in combat units. For example, M109 howitzers are unable to keep up with the newer Abrams tanks and Bradley fighting vehicles. The new vehicles also would provide platforms that could easily be tied into a rudimentary FCS network. They would represent the first new combat vehicles introduced into the Army's combat units since Stryker vehicles were fielded in 2002.

The Army would retain its existing Abrams tanks and Bradley fighting vehicles indefinitely under this alternative rather than replace them with vehicles developed in the FCS program. To prevent the average age of those vehicles from increasing, however, the Army would upgrade them sufficiently. It would also upgrade M113-based vehicles and M109 howitzers until those systems could be replaced by Stryker or FCS vehicles. As part of those upgrades, the Army would install appropriate hardware in the Abrams tanks and Bradley fighting vehicles so that they, too, could eventually be integrated into the network (see Table 3-1 on page 40).

By developing and fielding new vehicles to replace those that have, in one form or another, been in the Army's inventory for more than 40 years, this alternative would greatly enhance the lethality and technological sophistication of a large portion of the Army's combat vehicles. The FCS vehicles that would replace the M113-based vehicles and M109 howitzers in an HBCT would be equipped with better armaments and electronic gear. For example, the NLOS-C, as currently envisioned, would be capable of higher rates of fire than the A6 version of the M109 howitzer and, because of its improved fire-control systems, would be more accurate in its delivery of artillery rounds. Likewise, the FCS mortar would be a more lethal weapon than the mortar on the M113-based vehicle, capable of firing more quickly and with more rounds per minute. In addition, both FCS vehicles should be more fuel-efficient than their predecessors. Finally, the fielding of the sophisticated FCS medical evacuation and treatment vehicle that is part of this alternative could enhance the survivability of soldiers who are wounded on the battlefield.

Under this alternative, the Army would cancel several portions of the FCS program and reduce others. Specifically, it would do the following:

- Cancel all programs to develop and procure unmanned systems, including both classes of unmanned aerial vehicles, all unmanned ground vehicles, the NLOS launch system, and the unattended ground sensors;⁸
- Cancel the development and procurement of the manned ground vehicles (the mounted combat system and the reconnaissance and surveillance vehicle) that are slated to perform missions currently assigned to the Abrams tank and the scout version of the Bradley fighting vehicle;
- Reduce by about 75 percent the number of FCS infantry carrier vehicles purchased per combat brigade to reflect the fact that the Bradley fighting vehicles would be retained in the heavy brigades;
- Cancel the planned programs for the FCS maintenance and recovery vehicle (because the Abrams tanks would be retained and thus so would the current M88A2 heavy recovery vehicle); and
- Scale back procurement of the FCS network, a version of which would be developed and fielded under this alternative, to reflect the smaller number of systems that it would have to support in each combat brigade.

Costs and Procurement Schedule Under Alternative 2

The costs of implementing this alternative would be greater than those of Alternatives 1 and 3, requiring a total investment of \$133 billion from 2009 through 2030, according to CBO's estimates. Of that total, \$76 billion would be needed to develop and procure the five variants of manned FCS vehicles and network components. Because the Army under this alternative would pursue only a subset of the FCS components included in the previous Administration's 2009 plan, it would be able to purchase two brigades' worth of the manned FCS vehicles each year beginning in 2016. At that rate, the Army would be able to equip all 26 of its heavy combat brigades

8. By canceling development of those systems being fielded by the FCS Spin-Out program, this alternative would effectively cancel that program as well.

with some FCS vehicles by 2029. The cost of upgrading the armored combat vehicles retained under this alternative would total \$57 billion from 2009 through 2030, the bulk of which—\$55 billion—would be for procurement (see Table 3-2 on page 44).

The manned vehicles are among the most technically challenging FCS components to develop. As a result, they are not scheduled to go into production until 2013. Under this alternative, the Army would not begin to purchase full brigade sets of those systems until 2015. The annual funding required to implement this alternative would thus be less than that for the previous alternative and for the previous Administration's 2009 plan until 2016 (see Figure 3-4 on page 45). Thereafter, annual funding would be slightly higher under this alternative, at about \$7 billion to \$9 billion, than under Alternative 1 but still significantly below that required under the previous Administration's 2009 plan.

Effects of Alternative 2 on the Army's Fleet of Armored Combat Vehicles

The Army would introduce new armored combat vehicles faster under Alternative 2 than under the previous Administration's 2009 plan, keeping the average age of the active fleet of armored vehicles below 14 years through 2030 (see Figure 3-5 on page 46). However, because FCS vehicles are more expensive than upgrades to existing vehicles or new Stryker vehicles, this alternative would not reduce the age of the current fleet as quickly as would the others. As a consequence, the average age of the active armored vehicle fleet under Alternative 2 would be similar to that under the previous Administration's 2009 plan.

Effects of Alternative 2 on Technologies in the Army's Combat Brigades

This alternative would link more combat vehicles to the FCS-based network than the previous Administration's 2009 plan would have (see Figure 3-5). It would also modernize more heavy combat brigades with FCS vehicles (26) than would the previous Administration's 2009 plan (15). Under this alternative, all of the Army's HBCTs would be modernized and every combat vehicle would be linked to the new network. However, no new FCS sensors would be developed or fielded, and the combat vehicles in the heavy brigades would be able to receive information only from existing UAVs, sensors, and each other. Also, because none of the vehicles in the infantry

or Stryker BCTs would receive hardware to link them to the network, the total number of combat brigades receiving FCS technology under this alternative would be much lower than that under the previous Administration's 2009 plan or the other alternatives that CBO considered.

Advantages and Disadvantages of Alternative 2

Alternative 2 is unique among the approaches CBO considered in that it would introduce new vehicular technology into the Army's forces, thus offering the advantage that the service could retire some of its oldest armored vehicles earlier than under any of the other alternatives. In addition, it would modernize all of the Army's heavy BCTs more rapidly than the pace under the previous Administration's 2009 plan. The option's costs are greater than those of Alternatives 1 and 3 but considerably less than those of the previous Administration's 2009 plan.

Alternative 2 also has several disadvantages, some of which it shares with Alternative 1. Perhaps the most significant is that it would do nothing to introduce FCS technologies into the Army's Stryker or infantry brigades. Furthermore, it would forgo the development and fielding of FCS sensors to any of the Army's BCTs. As with the other two alternatives that CBO examined, the Army under this alternative would retain its fleets of Abrams tanks and Bradley fighting vehicles indefinitely and would have to incorporate the technology associated with the FCS network into those vehicles.

Alternative 3: Cancel All Portions of the Program Except the Network

The last alternative that CBO examined would preserve only that part of the FCS program involved in developing and supporting the network. The new capability—under this alternative, a scaled-down version of the network envisioned for the FCS program by the previous Administration—would then be integrated into existing armored vehicles and some trucks, such as the high mobility multipurpose wheeled vehicles. All other portions of the FCS program would be canceled.

This alternative takes an evolutionary approach, improving the capability of the armored vehicles in the Army's heavy combat brigades rather than replacing them with new vehicles based on unproven technology. By introducing into existing vehicles those portions of the network that have been developed—and have proved effective—

in the FCS program, the Army could take advantage of advances in technology and information sharing yet retain the best features of its current fleet (in particular, the high degree of survivability of the Abrams tank). The Army has used that type of approach previously to upgrade and introduce new technology into its armored combat vehicles, making them among the most capable—if not the most capable—weapon systems in the world. This alternative would also introduce the FCS network technology into the Army's Stryker and infantry brigades by installing the appropriate kits on Stryker vehicles and some HMMWVs in those units.

Costs and Procurement Schedule Under Alternative 3

CBO estimated the costs for two variants of this alternative. Alternative 3A would install network capability in all of the roughly 300 combat vehicles in the Army's HBCTs and SBCTs and into about 300 trucks in IBCTs. Alternative 3B would fully integrate only the small number of vehicles envisioned in the Army's Spin-Out program—about 80—into the network. Both variants would replace all existing M113-based vehicles with Stryker vehicles.

Because the Army would purchase the smallest amount of hardware under alternative 3B, it would be the least expensive of the options that CBO considered. Its associated total costs—\$83 billion—would cover developing and purchasing the hardware for the FCS network (\$18 billion) and upgrading existing armored vehicles and purchasing Stryker vehicles (\$65 billion) (see Table 3-2 on page 44). Alternative 3B would also require the smallest amount of annual funding—roughly \$4 billion to \$6 billion from 2013 through 2022 and \$2 billion to \$3 billion thereafter—despite the fact that 12 BCTs' worth of FCS network hardware would be purchased each year starting in 2014 (see Figure 3-4 on page 45). At such a high rate of procurement, the Army would purchase equipment for all of its BCTs by 2018.

Alternative 3A, because it would purchase more network hardware per BCT than Alternative 3B, would also be more expensive. Its cost for FCS-related hardware would amount to \$41 billion from 2009 through 2030; when costs associated with combat vehicle upgrades and purchases are included, the total cost for the alternative over that period reaches \$106 billion. Alternative 3A would purchase a maximum of eight BCTs' worth of FCS network hardware per year, yielding a total annual cost of

roughly \$8 billion from 2014 through 2021, when the last BCT's worth of equipment would be purchased.

Effects of Alternative 3 on the Army's Fleet of Armored Combat Vehicles

Under both variants of Alternative 3, the Army would retain its existing armored combat vehicles—with the exception of its M113-based vehicles—indefinitely. (That same effect is seen under Alternative 1.) Through upgrades to those vehicles, the average age of the active fleet of roughly 14,800 vehicles could be maintained between 8 years and 12 years through 2030. Nevertheless, the Army's armored combat fleet in 2040 under this alternative would comprise the same vehicles that it did in 2013, and none of the combat brigades would be equipped with any of the sensors that have been developed in the FCS program.

Effects of Alternative 3 on Technologies in the Army's Combat Brigades

Both variants of Alternative 3 would introduce FCS technology into the Army's BCTs more quickly than would have been the case under the previous Administration's 2009 plan (see Figure 3-5 on page 46). Under Alternative 3A, all of the combat vehicles in HBCTs and SBCTs, as well as 300 trucks in IBCTs, would be retrofitted with FCS hardware to allow them to be fully integrated into the network by 2023. In Alternative 3B, the Army could integrate a small fraction of vehicles in each brigade into the network even earlier, completing the task by 2019.

Even though each of the Army's BCTs would have some vehicles that were integrated into the network, however, those vehicles would be able to receive information only from sensors that exist currently or from each other (because this alternative would cancel the development and procurement of all FCS sensors). In addition, because Alternative 3B outfits roughly 17 percent of the combat vehicles in heavy and Stryker BCTs with network capability, a smaller number of combat vehicles would be equipped under this alternative than under the previous Administration's 2009 plan.

Advantages and Disadvantages of Alternative 3

The greatest advantage of Alternative 3B is its relatively low estimated cost—\$83 billion—from 2009 through 2030. If the more extensive fielding of network technology considered under Alternative 3A was desired, the total cost—\$106 billion—would be slightly more than

that of Alternative 1. Because both variants of Alternative 3 would invest so little in new technologies and equipment, however, they would offer the Army the least gain in terms of innovation. Under Alternatives 3A and 3B, the service would maintain the fleets of Abrams tanks,

Bradley fighting vehicles, and M109 howitzers that it has had for more than 20 years. Although connected by a new network and upgraded to keep them in working condition, those vehicles would offer nothing new to the Army's combat arsenal.